

CRYPTANALYSIS OF AN ENCIPHERED CODE PROBLEM — WHERE AN "ADDITIVE" METHOD OF ENCIPHERMENT HAS BEEN USED

WIRELESS INTELLIGENCE SERVICE						
W/T INTERCEPT						
W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNAL STRENGTH	GEOMETRIC
TO	FROM					REMARKS
Y	X		1/1 0900			TRANSCRIBED FROM ORIGINAL

GROUPS 27

70901 60730 74760 85760 97799 11228 73928 65464 05744 50524
78007 09507 84359 22365 12393 78565 32042 75017 62630 71764
40992 33739 75938 69713 19298 08276 89338

ITALIAN ARMY TRAFFIC
JANUARY 1, 1941

MESSAGE NO. 1

**CRYPTANALYSIS
OF AN ENCIPHERED CODE PROBLEM
— WHERE AN "ADDITIVE" METHOD
OF ENCIPHERMENT HAS BEEN USED**

By
WAYNE G. BARKER

INTRODUCTION

This book provides for the student of cryptanalysis an enciphered code problem where an "additive" method of encipherment has been used. The use of an "additive" to (super)encipher a digital code for a long time has been a traditional and conventional method of providing added-security to a basic code system.

Most countries at one time or another during their history have used some form of "additive" system for the (super)encipherment of diplomatic and military code systems. Indeed, it is probable that even today somewhere in this world there is an "additive" system being used.

Not only will the student find great enjoyment in solving the problem which forms the central feature of this book, but he also will probably gain much knowledge concerning an aspect of cryptography which generally has received little publicity.

In the problem encountered in this book the student will be introduced to what might be termed practical cryptanalysis; that is, the student will meet a type of cryptographic system that in the recent past has been widely used.

In order to read the plaintexts of the provided messages, the student has a twofold task: he must first solve the (super)encipherment system(s) used, then solve the basic code.

At this point comments are perhaps in order concerning terminology. By "additive" we mean a numerical key which in the encipherment process is "added" to basic code groups. The addition is done without carrying. Thus, for example, if the "additive" is 8633 and the basic code group is 7268, the enciphered code group becomes 5891, not 15901. Likewise, in the decipherment process, the "additive" is subtracted (without carrying) from the enciphered code group to obtain the original basic code group, i.e., $5891 - 8633 = 7268$. Two terms, too, are used with some frequency in this text:

placode and encicode. Both words were coined by the late William F. Friedman; and both are used frequently when describing code systems and enciphered code systems. Placode, a portmanteau word composed by joining the words "plain" and "code", means "plain code" or unenciphered code; whereas, encicode, another portmanteau word composed by joining the words "enciphered" and "code", means "enciphered code". In the solution of an enciphered code system, the cryptanalyst's efforts therefore are directed first at reducing encicode to placode. Thereafter, the solution of the placode should be easy, provided only that sufficient text be available.

Much thought went into deciding the manner in which to present the problem which forms the central feature of this book. Finally, the idea of providing a "miniature" or small-scale problem was hit upon. Thus, the "miniature" problem, which forms Chapter I, provides a guide for the student when he tackles the main problem in Chapters II and III. If the student will carefully follow the analysis of the "miniature" problem, difficulties with the main problem should be minimized — and, hopefully, the solution to the main problem will be assured. At any point during the solution of the main problem, if the student should reach an impasse, a careful referral or examination of the solution to the "miniature" problem should resolve the difficulty.

Finally, when solutions to all messages are reached, it is certain that the student will sit back, reflect on all that he has learned, and he may take well-deserved pride in his accomplishment!

Mission Viejo, California
August 1979

WGB

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CHAPTER I

A "MINIATURE" PROBLEM FOR THE STUDENT

The problem in this chapter is a realistic "small scale" version of the principal or "big" problem to come in the next two chapters. The problem in this chapter is presented essentially as a "learning aid" for the student. Thus, by learning how this "miniature" problem is solved, the student will be in a good position to solve the "big" problem to come.

Therefore, the student should carefully follow the cryptanalytic method used in attacking the problem in this chapter before he attempts to solve the "problem" in the following chapters.

In this "miniature" problem the enemy is using a simple two-digit code system where the code groups have been then (super)enciphered using an "additive". Each message contains a two-digit "message indicator" which informs the receiving code clerk where to commence using the "additive" in order to read the message.

Eleven messages, one which is in plaintext, have been intercepted, as follows:

Message No. 1

(intercepted at 0530 hours)

ABC de GGG

Group count 44.

08 92 53 43 78 57 17 24 55 45 90 93 15 12 75 32 76 39 10 13
78 51 65 20 82 52 48 00 59 54 49 53 49 45 16 17 88 61 95 41
32 31 12 92

Message No. 2

(intercepted at 0650 hours)

GGG de ABC

Group count 47.

27 60 12 39 01 44 94 70 70 41 82 37 05 99 30 11 76 53 45 11
80 80 36 84 95 41 43 66 56 48 61 43 94 28 82 59 03 12 90 62
11 66 98 95 65 39 88

Message No. 3

(intercepted at 0655 hours)

XYZ de STS

Group count 42.

06 64 65 43 21 30 30 95 75 51 83 31 84 50 43 12 11 40 74 11
81 90 28 86 42 13 41 76 39 59 05 57 57 96 57 82 18 85 00 21
11 85

Message No. 4

(intercepted at 0700 hours)

ABC de GGG

Group count 34.

06 64 65 84 37 82 30 95 77 59 85 23 81 06 43 94 46 36 40 38
49 90 93 78 55 44 66 55 39 03 39 14 51 17

Message No. 5

(intercepted at 0725 hours)

XYZ de STS

Group count 36.

27 60 12 39 38 43 51 26 15 43 82 35 13 92 48 27 76 53 64 87
43 45 73 76 95 50 99 31 39 81 17 43 08 90 36 24

Message No. 6

(intercepted at 0805 hours)

ABC de GGG

Group count 36.

45 59 11 70 53 56 54 64 43 09 84 95 61 40 10 12 17 69 43 74
29 17 60 10 81 90 28 32 43 13 50 34 39 59 63 41

Message No. 7

(intercepted at 0910 hours)

STS de XYZ

Group count 41.

06 64 65 72 41 36 65 95 79 59 85 23 81 46 43 58 11 25 31 29
99 90 08 86 38 79 24 28 39 75 21 03 26 57 78 82 13 42 56 55
29

Message No. 8

(intercepted at 1030 hours)

XYZ de STS

Group count 33.

85 22 62 44 29 82 66 69 06 59 39 50 53 99 79 64 74 15 80 95
50 23 66 95 84 75 43 08 00 28 16 03 33

Message No. 9

(intercepted at 1045 hours)

XYZ de STS

Group count 9.

TO ALBERT STOP CASUALTIES HEAVY WE ARE BEING OVERRUN.

Message No. 10

(intercepted at 1110 hours)

GGG de ABC

Group count 35.

74 00 41 27 81 53 36 73 79 43 01 76 95 68 59 85 03 78 47 43
83 57 82 59 03 12 90 62 11 66 98 95 65 39 88

Message No. 11

(intercepted at 1200 hours)

ABC de GGG

Group count 42.

85 22 62 85 35 82 18 69 08 69 75 02 53 64 45 94 21 57 06 95
68 07 20 31 48 42 43 58 42 51 03 57 35 90 72 21 41 96 52 12
39 84

The following information has been obtained from traffic analysis:

(1) Call-signs have been identified as:

ABC = IX Corps (Headquarters).

GGG = 98th Division (Headquarters).

XYZ = 1st Ranger Battalion (Headquarters).

STS = "C" Company, subordinate unit of the
1st Ranger Battalion.

(2) Identification of key personnel in the above units:

1. Major General Ruff G. Jones is the Commanding General of IX Corps.
2. Brigadier General Samuel F. Smith commands the 98th Division.
3. Colonel Jasper K. Albert commands the 1st Ranger Battalion.
4. Commanding Officer of "C" Company, unit of the 1st Ranger Battalion, is an officer whose last name is Grant.

Cryptanalytic attack against an enciphered code system such as the present normally consists in preparing a "message print" and a "message index" of the intercepted traffic.

In the "message print" the intercepted messages are individually numbered (for reference purposes) and are printed in a uniform manner with the lines designated in some manner, such as the first line of the message — perhaps with ten groups to each line — being line A, the second line, B, etc. Thus, any particular code group in the traffic will be identified as being within a particular message and therein within a particular line.

The "message index" is an index of all code groups that occur in the traffic. The code groups in the index are normally listed in numerical (or alphabetic) order. At the same time, each code group listed in the index will show:

- (1) The message number and line within that message from which the code group came.
- (2) A certain number of the code groups preceding the code group and a certain number of the code groups that follow the code group.

A typical "message print" is shown in APPENDIX "A" and the "message index" corresponding to this "message print" is shown in APPENDIX "B". The student should carefully examine the "message index" in APPENDIX "B" and note how each line of the index concerns a particular code group found within the "message print".

For example, in the "message index" (APPENDIX "B") we

might examine the code group 08884 which occurs in the "message index" as follows:

05	E	20413	54299	46827	27509	08884	34096	68086	35763	51971
08	E	20323	28133	46827	27509	08884	34096	88868	66886	95886
14	C	20387	68171	69152	31762	08884	86724	06233	88907	72116
15	B	20323	23570	81265	59019	08884	34951	35339	11080	39132
17	D	35357	34441	09782	34989	08884	52103	39614	39270	08245
20	C	20323	21245	29739	47022	08884	82071	31613	79059	43139
22	E	20404	09860	31893	89332	08884	02142	95240	51771	46489
23	C	07169	90806	19054	58938	08884	06809	80402	50763	38802
25	E	00594	56608	19636	41108	08884	34906	80402	04960	51971

It is seen that the group 08884 occurs nine times in the traffic listed or printed in the "message print". The locations of these occurrences are shown. Thus, for example, the first occurrence of the group 08884 occurs in Message No. 5 on line E, etc. In this particular index, the four preceding groups and four following groups are shown. It is seen, too, that in this particular index, though the "lines" are listed primarily by code group, secondarily (within code group) the lines are listed by message number.

One of the principal purposes of the "message index" is to find repetitions between messages. Thus, in the case of the listing of the code group 08884, above, it is seen that there is a "hit" of four successive groups between messages No. 5 and No. 8:

05	E	20413	54299	<u>46827</u>	<u>27509</u>	<u>08884</u>	<u>34096</u>	68086	35763	51971
08	E	20323	28133	<u>46827</u>	<u>27509</u>	<u>08884</u>	<u>34096</u>	88868	66886	95886

Since this is a fairly long repetition which likely could not have occurred by accident, it is probable that with the messages juxtaposed at this point, the two messages have been enciphered with the same "additive"!

But at this point let us return to our "miniature" problem —

With the object of finding repetitions between messages, in the present "miniature" problem a "message index" might be made. Since this is only a small-scale problem, intended to show the student the method to attack the principal problem in the following chapters, a "message index" for the present

problem, however, will not be made. Instead, the "beginning groups" of the intercepted messages will be examined:

Message No. 1	—	08	92	53	43	78	57	17	24	55	.	.	.
Message No. 2	—	27	60	12	39	01	44	94	70	70	.	.	.
Message No. 3	—	06	64	65	43	21	30	30	95	75	.	.	.
Message No. 4	—	06	64	65	84	37	82	30	95	77	.	.	.
Message No. 5	—	27	60	12	39	38	43	51	26	15	.	.	.
Message No. 6	—	45	59	11	70	53	56	54	64	43	.	.	.
Message No. 7	—	06	64	65	72	41	36	65	95	79	.	.	.
Message No. 8	—	85	22	62	44	29	82	66	69	06	.	.	.
Message No. 9	—	(plaintext message)											
Message No. 10	—	74	00	41	27	81	53	36	73	79	.	.	.
Message No. 11	—	85	22	62	85	35	82	18	69	08	.	.	.

Usually it is good cryptanalytic practice to "line up" or arrange messages from their "beginnings", as above, when examining an unknown cryptographic system. The cryptanalyst at this point is somewhat "in the dark" in that he really is not sure what he is looking for, other than he would like to find anything unusual, anything that probably has not occurred by chance. In the case of an enciphered code system, the cryptanalyst would especially like to identify which group or groups in the messages are acting as discriminators or indicators. Is there a pattern, for example, in groups that occupy certain positions in the messages? If a pattern is found in groups in certain positions, it would probably indicate that these groups are "indicator groups". As is often the case, however, if the "indicator groups" are enciphered, their detection will be more difficult.

In the "beginnings" shown above, there does not appear to be any particular pattern in groups in any particular position. But three messages have the same beginning:

Message No. 3	—	<u>06</u>	<u>64</u>	<u>65</u>	43	21	30	30	95	75	.	.	.
Message No. 4	—	<u>06</u>	<u>64</u>	<u>65</u>	84	37	82	30	95	77	.	.	.
Message No. 7	—	<u>06</u>	<u>64</u>	<u>65</u>	72	41	36	65	95	79	.	.	.

Moreover, even in the few beginning groups there can be seen other "hits" between the messages:

Message No. 3	—	<u>06</u>	<u>64</u>	<u>65</u>	43	21	30	<u>30</u>	<u>95</u>	75	.	.	.
Message No. 4	—	<u>06</u>	<u>64</u>	<u>65</u>	84	37	82	<u>30</u>	<u>95</u>	77	.	.	.
Message No. 7	—	<u>06</u>	<u>64</u>	<u>65</u>	72	41	36	<u>65</u>	<u>95</u>	79	.	.	.

At this point we might superimpose the three messages and look for other "hits" between the messages:

Message No. 3	—	06	64	65	43	21	30	<u>30</u>	<u>95</u>	75	51	83	31	84	50	<u>43</u>
Message No. 4	—	06	64	65	84	37	82	<u>30</u>	<u>95</u>	77	59	85	23	81	06	<u>43</u>
Message No. 7	—	06	64	65	72	41	36	<u>65</u>	<u>95</u>	79	<u>59</u>	<u>85</u>	<u>23</u>	<u>81</u>	46	<u>43</u>

	12	<u>11</u>	40	74	11	81	<u>90</u>	28	86	42	13	41	76	<u>39</u>	59
	94	<u>46</u>	36	40	38	49	<u>90</u>	93	78	55	44	66	55	<u>39</u>	03
	58	<u>11</u>	25	31	29	99	<u>90</u>	08	86	38	79	24	28	<u>39</u>	75

	05	57	57	96	57	<u>82</u>	18	85	00	21	11	85.
	39	14	51	17.								
	21	03	26	57	78	<u>82</u>	13	42	56	55	29.	

With the large number of "hits" between these three messages it is evident that all have been enciphered with the same "additive".¹

We are now in a position to examine those enciphered code groups (enciccode) that have been enciphered with the same "additive". If there is a characteristic in the unenciphered code groups (placode), the characteristic may often be found by examining those enciphered groups that have been enciphered with the same "additive". This is a very important point and the student should thoroughly understand it.

A characteristic in the unenciphered code groups (placode) may take a number of forms: certain positions in the placode may be odd or even; digits in certain positions may "sum" to certain values; in a four-digit code, for example, the first three digits may "sum" to the value of the fourth; or there may be certain limitations in the code groups, such as the code groups are of five digits, running from 00000 to 25000, etc.

By examination of enciphered code groups that have been enciphered with the same "additive" the characteristics of the placode may often be found.

As but one example, consider a code where the placode

1. We are assuming here that we know the general type of system that the enemy is using, i.e., a code enciphered with an "additive".

groups "sum to zero". That is, a placode group such as 8967 might well be a valid group, as $8 + 9 + 6 + 7 = 0$, whereas 6639 could not be a valid placode group, since $6 + 6 + 3 + 9$ does not equal zero.

Consider valid placode groups with this characteristic being enciphered with the same "additive":

placode	8967	6068	0703	7779	5320
	+2365	+2365	+2365	+2365	+2365
encicode	<u>0222</u>	<u>8323</u>	<u>2068</u>	<u>9034</u>	<u>7685</u>

If we examine the enciphered code groups (the encicode groups), all of which have been enciphered with the same "additive" (in this case 2365), it will be seen that they all "sum to six", which is the sum of the digits in the "additive". Further, it may be noted that if two encicode groups which have been enciphered with the same additive are subtracted from one another, the effect of the "additive" is eliminated, and the result will have the same characteristic of the placode. Thus, if 0222 be subtracted from 8323, the result will be 8101, which has the same characteristic as the placode, i.e., its digits "sum to zero".

Though characteristics of the placode may often be found by examining enciphered code groups known to be enciphered with the same "additive", if the placode itself is random, there will of course be no characteristics to find.

In the case of the three superimposed messages there appears to be no characteristic evident in those groups that are (presumably) enciphered with the same "additive". This, of course, is somewhat of a disappointment, but...

We suddenly notice something else! The locations of the "hits" between messages are noted. In each of the three messages every seventh group is the same! That is, each message begins with 06; seven groups later occurs 95, seven groups later, 43, then 90, then 39, and 82! This is hardly by accident. But what does it mean?

We quickly turn to other messages and search for the groups 06, 95, 43, 90, 39, and 82, each with six intervening groups.

In Message No. 1 we find a portion of the same series:

08 92 53 43 78 57 17 24 55 45 90 93 15 12 75 32 76 39 10 13
78 51 65 20 82 52 48 00 59 54 49 53 49 45 16 17 88 61 95 41
32 31 12 92

It appears that the series continues, following the 82, 53 and 95.

Message No. 2 confirms the series:

27 60 12 39 01 44 94 70 70 41 82 37 05 99 30 11 76 53 45 11
80 80 36 84 95 41 43 66 56 48 61 43 94 28 82 59 03 12 90 62
11 66 98 95 65 39 88

The complete series appears to be cyclical: 39, 82, 53, 95, 43, and 90 — six numbers in length.

It thus appears that these (presumably) null groups in some fashion serve as a check to the decoding code clerk that the "additive" (of the system) is being used correctly.

From a cryptanalytic viewpoint, however, the null groups serve as an easy, convenient way to place messages in depth, i.e., to correctly superimpose messages so that all groups using a given group of "additive" will be beneath each other.

It would appear then that the enemy is using one page of "additive" for all messages. The page of "additive" is probably in the form of a square, in this case 6 x 6, such as the following:

	1	2	3	4	5	6	
1							39
2							82
3							53
4							95
5							43
6							90

At this point, of course, we do not know the particular thirty-six "additives" that fill the "additive" or enciphering square; nor can we be sure, though we do know their relative order, whether the "check groups" are placed correctly in relation to the square coordinates.

By means of the now known "check groups" we may now place all messages "in depth" as follows:

(90)	(39)	(82)	(53)
¹ 90 93 15 12 75 32 76 39 10 13 78 51 65 20 82 52 48 00 59 54 49 53 ¹			
	#2(27 60 12 39 01 44 94 70 70 41 82 37 05 99 30 11 76 53 ²		
² 90 62 11 66 98 95 65 39 88) ²			#3(06 ³
³ 90 28 86 42 13 41 76 39 59 05 57 57 96 57 82 18 85 00 21 11 85) ³			
⁴ 90 93 78 55 44 66 55 39 03 39 14 51 17) ⁴			#4(06 ⁴
	#5(27 60 12 39 38 43 51 26 15 43 82 35 13 92 48 27 76 53 ⁵		
⁶ 90 28 32 43 13 50 34 39 59 63 41) ⁶		#6(45 59 11 70 53 ⁶	
¹¹ 90 72 21 41 96 52 12 39 84) ¹¹			#7(06 ⁷
⁷ 90 08 86 38 79 24 28 39 75 21 03 26 57 78 82 13 42 56 55 29) ⁷			
	#8(85 22 62 44 29 82 66 69 06 59 39 50 53 ⁸		
¹⁰ 90 62 11 66 98 95 65 39 88) ¹⁰		#10(74 00 41 27 81 53 ¹⁰	
	#11(85 22 62 85 35 82 18 69 08 69 75 02 53 ¹¹		

(95)	(43)
¹ 49 45 16 17 88 61 95 41 32 31 12 92) ¹	
	#1(08 92 53 43 78 57 17 24 55 45 ¹
² 45 11 80 80 36 84 95 41 43 66 56 48 61 43 94 28 82 59 03 12 ²	
³ 64 65 43 21 30 30 95 75 51 83 31 84 50 43 12 11 40 74 11 81 ³	
⁴ 64 65 84 37 82 30 95 77 59 85 23 81 06 43 94 46 36 40 38 49 ⁴	
⁵ 64 87 43 45 73 76 95 50 99 31 39 81 17 43 08 90 36 24) ⁵	
⁶ 56 54 64 43 09 84 95 61 40 10 12 17 69 43 74 29 17 60 10 81 ⁶	
⁷ 64 65 72 41 36 65 95 79 59 85 23 81 46 43 58 11 25 31 29 99 ⁷	
⁸ 99 79 64 74 15 80 95 50 23 66 95 84 75 43 08 00 28 16 03 33) ⁸	
¹⁰ 36 73 79 43 01 76 95 68 59 85 03 78 47 43 83 57 82 59 03 12 ¹⁰	
¹¹ 64 45 94 21 57 06 95 68 07 20 31 48 42 43 58 42 51 03 57 35 ¹¹	

Since the "check groups" are in effect "nulls" and provide no textual content to the messages, for convenience in analyzing the messages now "in depth", we may eliminate the "check groups" entirely from the worksheets, so that we have the following:

	11	12	13	14	15	16	21	22	23	24	25	26	31	32	33	34	35	36	41	42	43	44					
¹	93	15	12	75	32	76	10	13	78	51	65	20	52	48	00	59	54	49	49	45	16	17 ¹					
				#2	(27	60	12	01	44	94	70	70	41	37	05	99	30	11	76	45	11	80	80 ²				
²	62	11	66	98	95	65	88)	²										#3	(06	64	65	43	21 ³				
³	28	86	42	13	41	76	59	05	57	57	96	57	18	85	00	21	11	85)	³								
⁴	93	78	55	44	66	55	03	39	14	51	17)	⁴							#4	(06	64	65	84	37 ⁴			
				#5	(27	60	12	38	43	51	26	15	43	35	13	92	48	27	76	64	87	43	45 ⁵				
⁶	28	32	43	13	50	34	59	63	41)	⁶								#6	(45	59	11	70	56	54	64	43 ⁶	
¹¹	72	21	41	96	52	12	84)	¹¹											#7	(06	64	65	72	41 ⁷			
⁷	08	86	38	79	24	28	75	21	03	26	57	78	13	42	56	55	29)	⁷									
				#8	(85	22	62	44	29	66	69	06	59	39	50	99	79	64	74 ⁸								
¹⁰	62	11	66	98	95	65	88)	¹⁰										#10	(74	00	41	27	81	36	73	79	43 ¹⁰
				#11	(85	22	62	85	35	18	69	08	69	75	02	64	45	94	21 ¹¹								

	45	46	51	52	53	54	55	56	61	62	63	64	65	66
¹	88	61	41	32	31	12	92)	¹						
				#1	(08	92	53	78	57	17	24	55	45 ¹	
²	36	84	41	43	66	56	48	61	94	28	82	59	03	12 ²
³	30	30	75	51	83	31	84	50	12	11	40	74	11	81 ³
⁴	82	30	77	59	85	23	81	06	94	46	36	40	38	49 ⁴
⁵	73	76	50	99	31	39	81	17	08	90	36	24)	⁵	
⁶	09	84	61	40	10	12	17	69	74	29	17	60	10	81 ⁶
⁷	36	65	79	59	85	23	81	46	58	11	25	31	29	99 ⁷
⁸	15	80	50	23	66	95	84	75	08	00	28	16	03	33) ⁸
¹⁰	01	76	68	59	85	03	78	47	83	57	82	59	03	12 ¹⁰
¹¹	57	06	68	07	20	31	48	42	58	42	51	03	57	35 ¹¹

It may be noted, also, that we have now numbered the columns, with the system of numbering following the

general coordinate pattern of the "additive" or enciphering square shown earlier on page 9.

We may assume though that each message begins at some point within the "additive" square, and that the "beginning point" of the "additive" used for a message is indicated in some manner by a group (or groups) termed a "message indicator" within the message. In the present case, since coordinates are a common method of designating points within a square, we have arbitrarily given the vertical and horizontal coordinates the numbers 1 through 6.

A search for the "message indicator" follows along the following lines —

Since a "message indicator" is usually found in the first several or last several groups of a message, we might make a tabulation such as the following:

Message No.	Message Begins with Column	Group Count	Time	To	From	1st Group	2nd Group	3rd Group	3rd from Final Group	2nd from Final Group	Final Group
1	54	38	0530	ABC	GGG	08	92	53	31	12	92
2	14	40	0650	GGG	ABC	27	60	12	65	39	88
3	36	37	0655	XYZ	STS	06	64	65	21	11	85
4	36	30	0700	ABC	GGG	06	64	65	14	51	17
5	14	31	0725	XYZ	STS	27	60	12	90	36	24
6	33	31	0805	ABC	GGG	45	59	11	59	63	41
7	36	36	0910	STS	XYZ	06	64	65	56	55	29
8	22	29	1030	XYZ	STS	85	22	62	16	03	33
10	32	30	1110	GGG	ABC	74	00	41	65	39	88
11	22	36	1200	ABC	GGC	85	22	62	12	39	84

It is noted that in each case where messages begin with the same "additive", i.e., where messages begin at the same point within the enciphering square (in this case a 6 x 6 square), though the first three groups of the messages are similar, the last three groups are different. From this we may assume that the "message indicator" is in the first

three groups of a message rather than in the last three groups.

There is another point that we should consider: if we presume that the "message indicator" is one group, the text of a message will actually begin not with the "beginning point" indicated in the tabulation above, but with the next point; that is, if the tabulation shows that a message begins with column (or point) 54, the actual beginning of the message would be 55. Let us now look at the first three groups of each message, together with the now, revised actual "beginning points" of the messages:

<u>Message Begins with Column</u>	<u>1st Group</u>	<u>2nd Group</u>	<u>3rd Group</u>
55	08	92	53
15	27	60	12
41 ²	06	64	65
41 ²	06	64	65
15	27	60	12
34	45	59	11
41 ²	06	64	65
23	85	22	62
33	74	00	41
23	85	22	62

From the three groups at the beginning of a message can we now somehow come up with the "beginning point"? We see success very quickly: if the 3rd group is subtracted (without carrying) from the 1st group, the result is the "beginning point"! Thus, for example, in the first message, $08 - 53 = 55$; or in the second message, $27 - 12 = 15$, etc. It is therefore likely that the "message indicator" is the first group of the message, obtained by adding the "beginning point" of the "additive" used to the second enciphered code group (which becomes the third group in the message when the "message indicator" is placed as the first group).³

2. The "beginning point" following 36 is 41.

3. It is true that the "message indicator" might have been formed by subtracting the "beginning point" from the first group and then inserted as the third group in the message.

A few comments may be made here:

In the present case we had very fortunately (or luckily) designated the columns of the worksheets (containing the messages "in depth") with the correct, as it turned out, "additive" square coordinate designations. In actual practice, however, the cryptanalyst must consider that the columns, though in relative correct order, may not be correctly designated. With sufficient number of messages, however, and taking into consideration those messages that have been enciphered with "additive" one position removed, or on the same row of the "additive" or enciphering square, the "message indicator(s)" may still be identified.

In the present case, too, only the "beginning point" of the "additive" used was enciphered (by adding the "beginning point" to the second enciphered group), but often the message indicator will indicate the group-count of the message and perhaps even the ending point of the "additive used". Thus, the message indicator(s) may serve many multiple purposes other than merely conveying the "beginning point" of "additive" used.

In the present problem we first put messages "in depth" and then attacked the indicator system. In actual practice, however, the cryptanalyst would probably have attacked the indicator system first, then put the messages "in depth", since the solution of the indicator system would have made the task of putting messages "in depth" almost mechanical. If the initial attack against the indicator system failed, the cryptanalyst of course could still fall back upon putting messages "in depth" simply by means of repetitions or "hits" between messages.

The student should realize that there are innumerable methods of enciphering "message indicators". Sometimes there is a completely different system, distinct from the system used for enciphering the coded text, used for enciphering indicators. The concept or idea of using one or more groups of enciphered (coded) text as key for the

encipherment of the "message indicator", however, is common.

Let us turn our attention now to the problem of "stripping" additive from the messages "in depth". For convenience we have eliminated the "message indicator" groups from the messages "in depth" and again for convenience we have re-numbered the columns on the worksheets simply from 01 to 36.

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22

¹93 15 12 75 32 76 10 13 78 51 65 20 52 48 00 59 54 49 49 45 16 17¹
#2(60 12 01 44 94 70 70 41 37 05 99 30 11 76 45 11 80 80)²
²62 11 66 98 95 65 88)² #3(64 65 43 21)³
³28 86 42 13 41 76 59 05 57 57 96 57 18 85 00 21 11 85)³
⁴93 78 55 44 66 55 03 39 14 51 17)⁴ #4(64 65 84 37)⁴
#5(60 12 38 43 51 26 15 43 35 13 92 48 27 76 64 87 43 45)⁵
⁶28 32 43 13 50 34 59 63 41)⁶ #6(59 11 70 56 54 64 43)⁶
¹¹72 21 41 96 52 12 84)¹¹ #7(64 65 72 41)⁷
⁷08 86 38 79 24 28 75 21 03 26 57 78 13 42 56 55 29)⁷
#8(22 62 44 29 66 69 06 59 39 50 99 79 64 74)⁸
¹⁰62 11 66 98 95 65 88)¹⁰ #10(00 41 27 81 36 73 79 43)¹⁰
#11(22 62 85 35 18 69 08 69 75 02 64 45 94 21)¹¹

23 24 25 26 27 28 29 30 31 32 33 34 35 36

¹88 61 41 32 31 12 92)¹
#1(92 53 78 57 17 24 55 45)¹
²36 84 41 43 66 56 48 61 94 28 82 59 03 12)²
³30 30 75 51 83 31 84 50 12 11 40 74 11 81)³
⁴82 30 77 59 85 23 81 06 94 46 36 40 38 49)⁴
⁵73 76 50 99 31 39 81 17 08 90 36 24)⁵
⁶09 84 61 40 10 12 17 69 74 29 17 60 10 81)⁶
⁷36 65 79 59 85 23 81 46 58 11 25 31 29 99)⁷
⁸15 80 50 23 66 95 84 75 08 00 28 16 03 33)⁸
¹⁰01 76 68 59 85 03 78 47 83 57 82 59 03 12)¹⁰
¹¹57 06 68 07 20 31 48 42 58 42 51 03 57 35)¹¹

To commence our attack against the messages "in depth"

we naturally will take advantage of any collateral information we might have concerning the enemy's method of writing messages, phraseology, stereotypes used, etc.

If we have been "reading" previous messages, perhaps in a different system, we will have a good idea of the "form" in which the enemy produces their messages. Or we may have available simultaneous with the enciphered messages, other messages in plaintext. It may happen, for example, that the same numbering system is used for both plain and enciphered messages. By taking advantage of the times of intercept of all messages we may even be able to forecast not only the location of the message number in an enciphered message, but the message number itself! Thus, normally a so-called "blind attack" against a system is not made: there should almost always be some information of a collateral nature which will assist in identifying probable words (or perhaps even phrases) in an enciphered message.

In the present instance we have available one plaintext message:

Message No. 9
(intercepted at 1045 hours)
XYZ de STS
Group count 9.
TO ALBERT STOP CASUALTIES HEAVY WE ARE BEING OVERRUN.

We also have collateral information obtained through traffic analysis: not only have we identified the call-signs, but we know the names of the commanders of the enemy units concerned.

From this available information we have a good idea of at least some of the words in the enciphered messages. Let us see now how we use this information.

Consider Messages Nos. 3, 4, and 7 which begin at the same point and use the same additive. It is noted particularly that the first two groups of each message are the same.

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

#3(64 65 43 21 30 30 75 51 83 31 84 50 12 11 40...

#4(64 65 84 37 82 30 77 59 85 23 81 06 94 46 36...

#7(64 65 72 41 36 65 79 59 85 23 81 46 58 11 25...

Let us underline the repetitions or "hits" between these three messages:

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

#3(64 65 43 21 30 30 75 51 83 31 84 50 12 11 40...

#4(64 65 84 37 82 30 77 59 85 23 81 06 94 46 36...

#7(64 65 72 41 36 65 79 59 85 23 81 46 58 11 25...

Here we might make a hypothesis: Since the plaintext message, above, began TO ALBERT STOP, can it be that the enciphered messages also begin with the word TO and contain perhaps the word STOP?

From the call-signs let us see to whom each message is going:⁴

<u>Message No.</u>	<u>Call-signs</u>	<u>To</u>
3	XYZ de STS	ALBERT
4	ABC de GGG	JONES
7	STS de XYZ	GRANT

We are immediately struck by the possibility now that each group represents a single plaintext letter! If this is correct, this would explain why the first two groups are the same: they represent the word T O.

4. Call-signs such as "XYZ de STS" means that the message is being transmitted to XYZ from STS. Thus, the radio abbreviation "de" means "from". See pages 3 and 4 for the identifications of the call-signs and identification of personnel in the units.

Confirmation of our identifications, 00 = t, and 08 = s, appears when we look at column 27 where the additive becomes 85, i.e.:

	27
relative additive =	<u>85</u>
	83
placode =	08
	s
	85
placode =	00
	t
	85
placode =	00
	t

Additional identifications are evident when we look at other columns. The placode group for the letter "r" is obtained when we put the placode values for "s" and "t" in column 25:

	25
relative additive =	<u>79</u>
	75
placode =	06
	r
	77
placode =	08
	s
	79
placode =	00
	t

With placode group 06 = r, we may insert this value as "r" into column 22 and find the placode values of "l" and "o":

	22
relative additive =	<u>45</u>
	21
placode =	86
	l
	37
placode =	92
	o
	41
placode =	06
	r

Column 29 yields the placode value of the letter "p":

		29
relative additive	=	92
		84
placode	=	92
		o
		81
placode	=	99
		p
		81
placode	=	99
		p

We now have six placode values: 86 = l, 92 = o, 99 = p, 06 = r, 08 = s, and 00 = t.

When Messages Nos. 6 and 10 are added to the above three messages (Nos. 3, 4, and 7), many additional placode values can be found:

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
additive =	<div> <div>45</div> <div>79 51 85</div> <div>92</div> </div>															
	<div> <div>#3</div> <div>(64 65 43 21 30 30 75 51 83 31 84 50</div> <div>86 06 00 08 92</div> <div>t o a l b e r t s t o p</div> </div>															
	<div> <div>#4</div> <div>(64 65 84 37 82 30 77 59 85 23 81 06</div> <div>92 08 08 00 99</div> <div>t o j o n e s s t o p</div> </div>															
	<div> <div>#7</div> <div>(64 65 72 41 36 65 79 59 85 23 81 46</div> <div>06 00 08 00 99</div> <div>t o g r a n t s t o p</div> </div>															
	<div> <div>#6</div> <div>(59 11 70 56 54 64 43 09 84 61 40 10 12 17 69</div> <div>08 92 99 35 25</div> <div>t o j o n e s s t o p</div> </div>															
	<div> <div>#10</div> <div>(00 41 27 81 36 73 79 43 01 76 68 59 85 03 78 47</div> <div>08 99 08 00 86</div> <div>t o s m i t h s t o p s t</div> </div>															

It is evident that columns 23 and 24 will yield the placode values: 39 = b, 81 = n, 35 = a, and 56 = e.

With the numerous placode values already recovered, with many more almost mechanically capable of being recovered, the entire solution of the present "miniature" problem is virtually assured. At this point the entire solution is left to the student.

With the premise that the code groups represent single plaintext letters we may insert into the messages the presumed stereotype message beginnings:

19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

#3(64 65 43 21 30 30 75 51 83 31 84 50 12 11 40...
 t o a l b e r t s t o p

#4(64 65 84 37 82 30 77 59 85 23 81 06 94 46 36...
 t o j o n e s s t o p

#7(64 65 72 41 36 65 79 59 85 23 81 46 58 11 25...
 t o g r a n t s t o p

The code group 30 representing the letter "e" in column 24 in two messages looks good! And the repetition of 59 85 23 81, representing the word "stop" in two messages, also looks good! At this point it looks as if we are on the right track.

We may now establish an arbitrary base for the basic, unenciphered code, or placode. We do this by merely assuming that a particular "plaintext equivalent" represents any selected number. For example, we may select the group 00 as the placode equivalent of the letter "t". Inserting 00 into column 26 as the placode equivalent of "t" yields 51 as the relative additive for that column; and with the additive then known for the column (51), the placode group 08 is found to represent the letter "s". This may be shown as follows:

	26
relative additive =	<u>51</u>
	51
placode =	00
	t
	59
placode =	08
	s
	59
placode =	08
	s

There is, however, a point which should be discussed here. This concerns the "relativity" of both the additive and the placode groups so far recovered.

Consider the placode groups that have to this point been recovered:

a = 35
b = 39
e = 56
l = 86
n = 81
o = 92
p = 99
r = 06
s = 08
t = 00

If the student will remember, the first placode identification made was the arbitrary designation of "t" as 00. Thus, all the identifications (as well as the "additive" recovered) made to this point are based relatively on $t = 00$. The chance is very slim, of course, that in the actual code $t = 00$; but as far as our "solution" is concerned, as long as the placode groups are relatively equal to one another, and as long as the recovered "additive" is again relative to our established base ($t = 00$), messages can be read with little difficulty.

For various reasons, however, it is usually desirable to bring the solution to the same base as the original code. Often this cannot be done; but sometimes there are "guides" which will enable the analyst to adjust the recovered code groups to the original base. For example, in the case of a four-digit code, the digits may have as their placode equivalents the groups 0000, 1111, 2222, etc., and with these as a base for the digits 0, 1, 2, etc. the placode groups can be made relative to the original code. In the case of a one-part basic code, the problem of putting recovered placode groups on the same base as the original code groups

is greatly facilitated. Consider the present "miniature" problem. From the order of the digits in the first position of the so far recovered placode groups relative to the letters of the alphabet in alphabetical order, it is fairly evident that we are dealing with a one-part code. That is, when the plaintext equivalents (in this case the letters of the alphabet) are put in alphabetic order, the placode groups will be in numerical order.

Let us again take a look at the placode groups that have to this point been recovered:

a = 35
b = 39
e = 56
l = 86
n = 81
o = 92
p = 99
r = 06
s = 08
t = 00

If we add 7 to the first position of each of the above placode groups, the placode group representing the letter "a" will begin with a "zero" which perhaps may be logical in the case of a one-part code. The recovered placode groups would then appear as:

a = 05
b = 09
e = 26
l = 56
n = 51
o = 62
p = 69
r = 76
s = 78
t = 70

Though the first position of the groups now "looks good",

the placode groups are still not completely in numerical order. A little study will show that the only way in which all of the placode groups can be put in complete numerical order is to add 8 to the second position. The placode groups will then become:

a = 03

b = 07

e = 24

l = 54

n = 59

o = 60

p = 67

r = 74

s = 76

t = 78

We might assume then, at least to this point, that these placode groups are those of the original code.

THE CONCEPT OF "DIFFERENCES"

Before leaving the present problem there is one important item concerning "additive" systems in general which should be discussed. This concerns the concept of "differences" which the student should thoroughly understand if he wishes to be successful in cryptanalyzing an "additive-type" enciphered code system.

The concept of "differences" is based upon the fact that the difference between two placode groups is the same even though both are enciphered with the same additive. For example, the difference between the placode groups 24 ("e") and 03 ("a") is 21. If both are enciphered with an additive, say 62, the resulting encicoded groups will be 86 and 65, but the difference between the two still remains 21. (Note, incidentally, in taking the difference between two groups, we make the subtraction so that we will come up with the smallest difference, not the reciprocal larger difference.)

Let us examine now the use of this concept of "differences".

In the above list of recovered placode groups we may extract those that we might expect to occur most frequently. For example, we might extract the groups:

a = 03

e = 24

n = 59

o = 60

r = 74

s = 76

t = 78

A "Difference Table" may now be constructed for these high-frequency groups as follows:

	24	59	60	74	76	78
03	21	54	43	39	37	35
24		35	46	50	52	54
59			11	25	27	29
60				14	16	18
74					02	04
76						02

Note, again, that in subtracting one code group from another, the subtraction is made so that we will arrive at the smallest "difference" between the two groups, not the reciprocal larger difference. Thus, the "difference" between 03 and 59 is 54, not 56.

If these high-frequency placode groups occur within a particular column, we would expect to find these same "differences" within the column — even though an additive has been applied to the column. To prove this, let us take, as an example, column 31 from the messages "in depth" on page 15. The column contains the following encicode groups: 78, 94, 12, 94, 08, 74, 58, 08, 83, 58.

A "Difference Table" is constructed for these groups, eliminating those groups which occur more than once. (The multiple occurring groups, of course, are likely to be high-frequency groups.)

	94	12	08	74	58	83
78	26	44	30	04	20	15
94		28	14	20	46	11
12			14	48	46	39
08				34	50	25
74					26	19
58						35

We may now compare the "encicode group" differences (from column 31) with the "high-frequency group" differences:

High-Frequency Placode Group Differences

02 = 76-74, 78-76
 04 = 78-74
 11 = 60-59
 14 = 74-60
 16 = 76-60
 18 = 78-60
 21 = 24-03
 25 = 74-59
 27 = 76-59
 29 = 78-59
 35 = 03-78, 59-24
 37 = 03-76
 39 = 03-74
 43 = 03-60
 46 = 60-24
 50 = 24-74 (74-24)
 52 = 76-24
 54 = 03-59, 78-24

Encicode Group Differences of Groups in Column 31

04 = 78-74
 11 = 94-83
 14 = 08-94, 12-08
 15 = 83-78
 19 = 83-74
 20 = 78-58, 94-74
 25 = 08-83
 26 = 94-78, 74-58
 28 = 12-94
 30 = 08-78
 34 = 08-74
 35 = 83-58
 39 = 12-83
 44 = 12-78
 46 = 94-58, 58-12
 48 = 12-74
 50 = 08-58 (58-08)

The common differences in the above two lists may now be tabulated and the value of the additive necessary to make the high-frequency placode differences equal to the encicode group differences may be computed:

High-Frequency Placode Group Differences

04 = 78-74
 11 = 60-59
 14 = 74-60
 25 = 74-59
 35 = 03-78, 59-24
 39 = 03-74
 46 = 60-24
 50 = 14-74 (74-24)

Encicode Group Differences in Column 31

04 = 78-74
 11 = 94-83
 14 = 08-94, 12-08
 25 = 08-83
 35 = 83-58
 39 = 12-83
 46 = 94-58, 58-12
 50 = 08-58 (58-08)

+ Additive Necessary

00
 34
 34, 48
 34
 80, 34
 19
 34, 98
 94, 34

It is apparent that 34 stands out as the "additive" in Column 31. Thus, with 34 as the "additive" in Column 31, the resulting placode groups will predominantly be the "high-frequency" placode groups already identified:

	31	
additive	34	
	78	
placode	44	
	94	
placode	60	
	o	
	12	
placode	88	
	94	
placode	60	
	o	
	08	
placode	74	
	r	
	74	
placode	40	
	58	
placode	24	
	e	
	08	
placode	74	
	r	
	83	
placode	59	
	n	
	58	
placode	24	
	e	

high-frequency
plaintext
letters

During the stage of the solution of an additive-type system which comes after a number of messages have been put "in depth", differences may be used to put columns on a common base, even though no placode groups have yet been identified. For example, consider the worksheets on page 15. Without any knowledge of the placode groups, let us attempt to put the arbitrarily selected columns 32 and 34 on the same base.

"Difference Tables" are constructed for the encicode groups in columns 32 and 34 as follows:

Difference Table — Column 34

	59	74	40	60	31	16	03
24	35	50	26	46	17	18	21
59		25	19	11	28	43	54
74			34	14	43	42	39
40				20	19	34	47
60					39	54	43
31						25	38
16							13

Difference Table — Column 32

	28	11	46	90	29	00	42
57	39	46	11	43	38	53	15
28		17	28	38	01	28	24
11			35	21	18	11	31
46				54	27	46	04
90					39	10	52
29						29	23
00							42

Though encicode groups may repeat within a column, indicating that they likely are high-frequency groups, still for the purpose of the "Difference Table" they are counted only once.

The common "differences" between the two Difference Tables are now tabulated; and the relative "additives" necessary to be added to the encicode groups of Column 32 in order to make the groups equal to the encicode groups of Column 34 are computed:

Encicode Group Differences in Column 34	Encicode Group Differences in Column 32	Relative additives added to Groups in Column 32
11 = 60-59	11 = 57-46, 11-00	13, 59
17 = 31-24	17 = 28-11	13
18 = 24-16	18 = 29-11	05
21 = 24-03	21 = 11-90	13
28 = 59-31	28 = 46-28, 28-00	13, 31
35 = 59-24	35 = 46-11	13
38 = 31-03	38 = 57-29, 28-90	84, 13
39 = 03-74, 60-31	39 = 29-90, 57-28	84, 56, 41, 13
42 = 16-74	42 = 42-00	74
43 = 59-16, 74-31, 03-60	43 = 90-57	69, 84, 13
46 = 60-24	46 = 57-11, 46-00	13, 24
54 = 60-16, 03-59	54 = 90-46	70, 13

Of the twelve common differences between Columns 34 and 32, in nine of them, if 13 is added to the encicode groups of

Column 32, the groups (giving rise to the common difference) in Column 32 will equal those groups in Column 34. Thus, if 13 is added to the groups in Column 32, both columns will likely be on the same base.

At this point we shall take leave of this "miniature" enciphered code problem. If the student understands the solution which we have discussed, there is no reason why he should not be capable of solving completely the principal problem, the pièce de résistance, in the next two chapters.

CHAPTER II

PRELIMINARY REMARKS CONCERNING THE PROBLEM

The enciphered code problem which the student will face in the next chapter is an exceptionally good one. The problem, however, is not easy. The problem cannot be solved overnight, nor even in a week or two weeks. It will take the average student perhaps three or four months of several hours daily work to complete solution of all the messages. But the time will be well spent! The student will certainly receive a good deal of self-satisfaction from his solution. More importantly, he will have had a tremendous amount of enjoyment as he learns about an aspect of cryptanalysis that likely will be new to him.

Let us now take a look at this problem —

The scene of the problem is North Africa in January 1941. This problem, in English, was constructed by British cryptographers to duplicate the situation as well as the cryptographic systems then being used by the Italian Army. The purpose of this problem was to train British cryptanalysts, and especially those who would later face real Italian Army traffic in North Africa.

Solution to the problem will take certain steps:

(1) First, from examination of the traffic certain tentative assumptions can be made. It is seen that the traffic consists of 29 messages, one of which, Message No. 27, is in the "clear". It is seen, too, upon closer examination of the messages, that the messages seem to divide themselves into two categories, those that begin with ascending digits, 23456, 34567, 45678, etc., and those that begin with the digits 00000. We might make the assumption that we are dealing with two different systems. The "message index" (APPENDIX "B") may confirm this assumption, for if there are repetitions between messages that begin with the ascending digits, we can assume them to be in the same system; and if the 00000 messages have no repetitions with other messages, we can assume the 00000 messages to be

in a system distinct to themselves.

(2) By means of repetitions, and especially longer repetitions, certain messages can initially be put "in depth"; that is, we can be reasonably sure that these messages have been enciphered with the same additive. With the messages "in depth" groups enciphered with the same additive can be examined: is there any internal characteristic in the placode that might enable us to almost mechanically put all the messages "in depth"? Is there any other evident means of putting the messages "in depth"? Is it possible that there are, for example, "check groups" in the messages?

(3) After putting all the messages "in depth", which is no small task, considering the length and number of the messages, can any conclusion be reached as to the total number of additives in the system?

(4) With the messages "in depth" can the group or groups representing "message indicators" be identified? Here the student might keep in mind that a "message indicator" might indicate not only the "starting point" of the additive, but also perhaps the "time of transmission" of the message, the "group count" of the message, or the "ending point" of the additive. Of course not only should the groups near the beginning of a message be "suspect" as indicators, but groups at the end of the message should be considered as likely indicators.

(5) The next step is to begin reconstruction of relative placode. Here any encicode group can be assumed to represent any placode value, such as 00000, and relative additive for one column will have been recovered. If one or two of these placode groups are near the beginning of a message, can other messages in other columns have begun with the same placode groups? In other words, messages to the same call-signs might begin with the same placode groups!

(6) At this point, attention might be made to the one

message which is in plaintext, Message No. 27:

"FOR GENERAL GALLINA. I HAVE GIVEN ORDERS TO
CEASE RESISTANCE. GENERAL BERGINZOLI. 18.

The stereotype "beginning" and "ending" of this message indicates the probability that most of the encoded messages will likewise have similar "beginnings" and "endings" — depending of course on who is sending the message and to whom the message is being sent.

Of special interest, too, is the fact that Message No. 27 ends with a probable internal message number: 18. Perhaps all of the encoded messages likewise end with an internal message number; and might not Message No. 24, also to X from S, be numbered internally 17?

(7) Finally, attention may be paid to any messages that for some reason or other may not have been (super)enciphered like the others. These few messages may be in a system of their own! In fact, in a sense these messages may be considered the most delectable portion of the entire problem, the dessert so to speak. How may these messages be attacked? Analysis should begin with the assumption that the basic underlying placode of these messages is similar to that of the other messages. Knowing the pattern of the "beginnings" and "endings" of messages, as well as knowing the call-signs of the sending and receiving stations, should provide a certain amount of placode which can be joined with its likely encicode. At this point, persevering analysis of placode with encicode will lead to success!⁵

BACKGROUND TO THE PROBLEM

The background to this problem is the early part of the British offensive in Libya in January 1941, which culminated with the fall of Bardia on January 5. Though the text of the messages is English, the contents of the messages are

5. A clue, however, perhaps may be found on page 469 of David Kahn's fine book, The Codebreakers, published by The Macmillan Company, New York.

realistic representations of those of the Italian Army.

The following extract from the Italian Order of Battle has recently been published by the Intelligence Branch of the General Staff and may be of some assistance:

			<u>Location</u>
ANTONELLI	General	Intendant-General (Supplies)	BENGHAZI
ARGENTINO	General	Commanding General	DERNA
BERGINZOLI	General	Commanding General	BARDIA
GALLINA	General	Commander-in-Chief, Eastern Libya, at advanced G.H.Q.	TOBRUK
LEO	Lt. Col.	Officer-in-Charge, Saharan Battalion	HON
RUFFO	Colonel	Second in Command	DERNA

The Wireless Intelligence Service has provided the following identifications of the Italian stations concerned:

<u>Station</u>	<u>Identification</u>
X	Advance H.Q., East Libya, near TOBRUK.
Y	BENGHAZI area (probable).
Q	DERNA (probable).
S	H.Q., BARDIA.
N	TOBRUK (Probable).
O	Believed to be a form of CQ call, a call addressed to all stations, since traffic is always to O, and never originates there.
P	HON.

CHAPTER III

THE PROBLEM

Between 0900 hours January 1, 1941 and 1230 hours January 5, 1941 the following 29 messages were intercepted:

WIRELESS INTELLIGENCE SERVICE W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO: Y	FROM: X		1/1 0900				TRANSCRIBED FROM ORIGINAL

GROUPS 27

78901 60730 74769 85760 97799 11228 73928 65464 05744 50524

78007 09597 84359 22385 12393 78565 32842 75017 62630 71764

40992 33739 75938 69713 19298 08276 89338

MESSAGE NO. 1

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO: X	FROM: Y		1/1 0930				TRANSCRIBED FROM ORIGINAL

GROUPS 26

34567 60730 74769 84260 03391 18187 52608 65464 17243 64171
07778 09597 48828 00755 53504 79786 97224 06828 90818 47758
84147 31012 75938 79319 69898 42339

MESSAGE NO. 2

WIRELESS INTELLIGENCE SERVICE
W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO: X	FROM: Y		1/1 1100				TRANSCRIBED FROM ORIGINAL

GROUPS 29

23456 51747 33040 45035 92588 93926 02329 56912 57146 73077
56769 67046 94811 51690 43998 23359 04198 80160 09597 19716
38488 39968 26233 15224 21026 14932 04830 92822 18800

MESSAGE NO. 3

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
0	N		1/1 1200				TRANSCRIBED FROM ORIGINAL

GROUPS 72

00000 21388 75980 09987 18562 54198 11084 46613 11533 42010
 73917 31834 77584 25231 53285 88416 00894 34207 09962 55107
 00510 94490 43118 28374 10746 36417 62180 44245 55171 39375
 98051 90702 26242 84663 85047 90709 26240 44842 55135 42507
 93162 61012 08101 22712 33316 71296 65938 22762 33338 47937
 75972 22900 56030 84258 50890 09751 47309 53375 30951 59811
 50244 96899 07317 72856 36254 50495 35184 40023 48499 99003
 74415 11805

MESSAGE NO. 4

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	CQ	FROM: X	1/1 1200				TRANSCRIBED FROM ORIGINAL

GROUPS 81

67890 85486 47842 72346 65464 70505 29830 87014 09597 71500
04932 97336 86649 90441 39903 49020 71683 52245 95650 75938
06160 08357 23453 48538 81390 02576 99476 53296 65187 01785
36730 27130 81966 40334 41596 62200 13486 20413 54299 46827
27509 08884 34096 68086 35763 51971 17318 14421 64417 12223
47187 15415 47831 74294 63677 07102 37759 33428 58806 74165
00369 77177 75296 56788 59874 21793 72055 51552 40147 10058
24017 93636 26300 34722 08346 28735 36404 04985 64758 39284
96522

MESSAGE NO. 5

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
Y	X		1/1 1700				TRANSCRIBED FROM ORIGINAL

GROUPS 34

12345 79790 06707 10217 63743 40357 60398 11887 47678 55827
51709 95294 75938 26264 42279 05420 42644 76095 54808 08066
43865 38400 68997 36730 41301 30513 40235 79296 23341 95497
41487 60109 56671 75931

MESSAGE NO. 6

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
0	N		2/1 1200				TRANSCRIBED FROM ORIGINAL

GROUPS 99

00000 21388 75980 44010 88488 04010 80086 89054 39823 79278
 26590 39940 43131 83413 41401 89989 55587 59811 50244 85833
 54220 08686 18073 31834 77584 25231 53285 58327 02484 24687
 66120 33992 00312 24103 53463 44217 99232 61012 08101 22710
 33314 71296 65938 22713 33316 85330 02361 39375 98051 90742

 26217 84663 85047 90762 26212 36011 92403 14384 54683 06696
 74423 95398 39231 23096 32993 50602 86357 98842 55747 00243
 55983 08718 92949 94490 43118 00677 45747 79769 18059 08737
 71120 42084 15901 42462 93639 39286 19584 68115 02849 24021
 63529 19266 83498 30453 91160 86733 66301 44710 88393

MESSAGE NO. 7

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
0Q	X		2/1 1200				TRANSCRIBED FROM ORIGINAL

GROUPS 110

34567 83185 93757 32758 87550 31934 14969 29692 23363 60274
 81885 09597 56195 88927 00084 83234 18783 08863 78992 00915
 01348 09118 75938 24194 08438 05789 88902 96446 51788 31508
 44590 76924 61728 36730 74908 69899 40415 22223 57276 57896
 20323 28133 46827 27509 08884 34096 88868 66886 95886 45027

 87152 04412 12133 11021 15415 47831 74200 63686 61738 80503
 26026 53883 55341 03734 57191 08894 56788 81671 00454 16951
 68942 54137 54707 47383 97777 17927 01109 08346 52660 69815
 94749 42416 52566 19857 13846 32538 49485 89015 72296 28563
 89954 80941 85636 26488 22813 44911 25161 35910 62200 78968

 40436 59777 97021 00194 08563 02651 88039 15573 76585 16901

MESSAGE NO. 8

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
X	Y		2/1 1900				TRANSCRIBED FROM ORIGINAL

GROUPS 23

45678 27678 86657 85127 09743 50429 52304 42160 62278 10915
35347 89450 72296 49146 98213 25433 01091 92472 67275 70753
76254 77776 68076

MESSAGE NO. 9

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
P	Q		3/1 1100				TRANSCRIBED FROM ORIGINAL

GROUPS 36

00000 47039 47124 87057 81440 59500 37134 40452 95726 22773
 33306 22772 33306 43769 22367 30912 23938 92842 45442 63306
 18447 00203 55463 89546 03256 62701 93387 47957 56542 52461
 35134 63029 00598 93272 62725 11364

MESSAGE NO. 10

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
0	N		3/1 1200				TRANSCRIBED FROM ORIGINAL

GROUPS 38

00000 21388 75980 09987 18562 91842 97538 17722 64318 33230
00454 39039 68539 09612 57916 79479 95167 20190 55088 76089
28079 47545 19419 63281 63442 81194 25979 32175 10780 39412
65663 80494 85667 40023 48499 99003 74415 11863

MESSAGE NO. 11

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO: CQ	FROM: X		3/1 1200				TRANSCRIBED FROM ORIGINAL

GROUPS 43

23456 88476 26633 34123 40178 62293 83786 64990 78893 89717
 38014 02400 56912 57155 47135 70400 87569 84180 00854 12944
 18406 34459 79225 09597 73316 05660 16641 31186 37132 26961
 65220 60869 71596 65982 75938 45328 08438 11367 53532 99303
 10830 02314 75658

MESSAGE NO. 12

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
Y	X		3/1 1300				TRANSCRIBED FROM ORIGINAL

GROUPS 24

56789 77418 56912 55401 23130 05042 22899 08618 97104 09620

49527 95207 50656 08547 09597 81528 74554 53504 92227 65071

32860 99163 90656 15734

MESSAGE NO. 13

WIRELESS INTELLIGENCE SERVICE
W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO: Q	FROM: X		3/1 1600				TRANSCRIBED FROM ORIGINAL

GROUPS 88

67890 82825 75938 03447 14724 18774 59512 55925 78320 76911
41828 89803 65060 70915 36730 31382 03546 40424 43631 73327
81818 20387 68171 69152 31762 08884 86724 06233 88907 72116
45883 19701 50827 27298 16468 59362 47831 45300 12829 92523
02090 82206 45042 26325 04697 05236 92941 56788 13846 79249
58757 16784 41738 31940 17632 78394 94186 49689 08346 52660
18029 98855 08999 14665 99640 46021 10956 60770 17815 72296
05306 95232 07828 53760 91315 49149 05595 45609 73039 30727
78968 90194 07645 66919 21177 60802 32317 20881

MESSAGE NO. 14

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
X	Q		3/1 1730				TRANSCRIBED FROM ORIGINAL

GROUPS 48

12345 93205 29567 49097 61498 79034 57357 57180 20323 23570
 81265 59019 08884 34951 35339 11080 39132 97787 91140 04594
 39477 99025 85071 47831 22198 55249 15117 43616 26038 31023
 82412 00853 89695 17876 56788 32008 20530 35625 01877 90742
 49854 49894 38560 43563 52956 28816 08346 96517

MESSAGE NO. 15

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
X	Q		4/1 0630				TRANSCRIBED FROM ORIGINAL

GROUPS 35

23456 71390 30934 45914 31563 01839 26488 36266 48201 02260
 76842 33636 78968 74472 23223 19621 87995 19234 20686 45136
 74412 24455 86493 56912 74309 91669 69083 79291 73568 28854
 75700 22645 05583 90584 64880

MESSAGE NO. 16

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	CQ	FROM: X	4/1 1200				TRANSCRIBED FROM ORIGINAL

GROUPS 97

45678 06788 67332 09839 20013 09597 92628 58839 43662 22897
 17048 60039 01655 84734 74917 69126 75938 25178 96522 43051
 15871 31467 17429 93788 14997 65187 19066 36730 19431 89180
 02514 26776 14358 22459 35357 34441 09782 34989 08884 52103
 39614 39270 08245 94260 10431 48702 12214 83552 52147 47831

 67610 63497 14594 75579 89892 12916 97446 04794 72325 25204
 56788 07385 83892 75765 45195 72085 49728 24022 50062 27248
 95594 08346 04073 68877 30482 96447 52566 86992 41511 99871
 29548 17648 72296 57638 93647 68574 08687 17014 39374 56639
 22602 40914 70213 78968 32423 90932 75623

MESSAGE NO. 17

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	SONIOMETRIC FTZ	REMARKS
TO:	FROM:						
0	N		4/1 1200				TRANSCRIBED FROM ORIGINAL

GROUP 86

00000 21388 75980 74006 15426 64834 89020 31384 99398 08718
 92949 94457 43192 91850 90213 58594 30248 28807 49010 23147
 97949 25972 53084 29734 16187 26103 43776 54198 11084 03512
 93107 98350 30353 31834 77584 98528 95389 33258 41785 91152
 67922 44018 88484 11148 10253 37201 66039 83763 89077 67272

 69437 99373 33908 44010 88488 78207 06423 82065 69523 37234
 66155 10512 22133 79278 26590 39940 43131 30481 05164 33922
 22954 84315 44550 23308 67045 18168 55008 76528 10566 49364
 97937 40023 48499 99003 77415 11860

MESSAGE NO. 18

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
X	Q		4/1 1630				TRANSCRIBED FROM ORIGINAL

GROUPS 29

56789 06441 89418 91468 84355 75498 82206 07408 08577 57290

10435 52639 56788 78449 53531 15104 39065 54446 18307 59348

74876 39324 00716 08346 62087 24802 13109 01136 73214

MESSAGE NO. 19

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
X	S		4/1 1700				TRANSCRIBED FROM ORIGINAL

GROUPS 81

89012 13667 74422 09942 61114 58774 78168 02576 07551 43865
 76924 61728 36730 16028 66495 24853 84149 09689 22683 20323
 21245 29739 47022 08884 82071 31613 79059 43139 50007 07484
 07101 27078 20218 92134 47831 18576 49284 58574 72333 44305
 02095 97571 99387 10260 25204 56788 63375 98430 19149 02646

 56690 31931 20409 72019 39243 82716 08346 49859 70204 83821
 49780 44138 57924 22564 47562 62651 91786 72296 10144 63305
 60912 01910 26488 23020 67596 72691 69334 59050 03458 78968
 34933

MESSAGE NO. 20

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	S	FROM: X	4/1 1830				TRANSCRIBED FROM ORIGINAL

GROUPS 34

78901 38482 97787 01247 54761 40195 91932 49674 73800 27054
 16174 02063 08346 30359 25401 57776 44284 33053 42160 55690
 42953 60245 02579 72296 05225 92627 10409 01091 92472 73877
 77612 60934 56456 68146

MESSAGE NO. 21

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
X	S		5/1 0700				TRANSCRIBED FROM ORIGINAL

GROUPS 77

67890 60730 74769 08760 03391 18187 52608 65464 71543 87203
 79225 09597 82140 45666 02756 84284 31450 97241 90818 59426
 32338 17817 75938 17283 97533 42961 04438 25035 52867 10494
 51954 17419 10857 36730 18954 03645 31439 84149 09689 49017
 20404 09860 31893 89332 08884 02142 95240 51771 46489 23198

 70621 79538 63421 27801 75656 47831 98887 63596 35519 25954
 40257 53883 39073 75669 05236 72911 56788 69119 99501 43804
 90106 67638 65837 18061 52002 28044 73169

MESSAGE NO. 22

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	S	FROM: X	5/1 0730				TRANSCRIBED FROM ORIGINAL

GROUPS 48

12345 86714 66802 86317 82621 90981 52159 75938 48550 08438
 45193 22732 56854 02495 19769 78117 65961 41821 36730 56164
 95398 49245 48749 34158 61477 07169 90806 19054 58938 08884
 06809 80402 50763 38802 13359 87186 35420 86088 54569 81059
 47831 30457 39661 89113 96633 02599 82044 97857

MESSAGE NO. 23

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
X	S		5/1 0830				TRANSCRIBED FROM ORIGINAL

GROUPS 62

34567 09659 08346 24805 28735 36404 04985 39284 52566 11297
 78420 30525 62677 85249 72296 74621 06765 88821 89609 02095
 21802 56639 03217 78968 59159 78968 48188 28769 00719 00013
 42813 09082 17410 35872 72943 12725 56912 22897 70210 08694
 52962 96934 67027 70558 16312 49097 12685 09597 19627 27004

 22057 07152 11901 11887 66802 82621 90981 52159 75938 64071
 48550 42274

MESSAGE NO. 24

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
CQ	X		5/1 1200				TRANSCRIBED FROM ORIGINAL

GROUPS 91

23456 83185 93757 33758 87550 50241 67713 14676 96743 83197
 33083 09597 82140 45666 02756 84284 31450 97241 47116 34577
 89082 04543 75938 97686 56422 92853 88908 78320 64675 22322
 65604 56101 63601 36730 79543 73187 19968 44143 30747 84730
 00594 56608 19636 41108 08884 34906 80402 04960 51971 12755

 59869 26246 80022 97715 95764 47831 45435 40196 26419 80503
 74878 26631 88157 90221 05317 02642 56788 28462 48531 93195
 08232 56546 14266 49894 39181 55307 79983 08346 52561 08847
 27561 07965 52485 42160 39425 58450 78896 02533 12276 72296
 49371

MESSAGE NO. 25

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
0	N		5/1 1200				TRANSCRIBED FROM ORIGINAL

GROUPS 81

00000 21388 75980 06957 12540 22288 60115 55305 00685 16057
 74530 22248 60115 20361 17114 18904 54478 63945 63933 73249
 91816 39490 43441 29972 54088 25552 16240 77802 16435 23308
 67045 47993 11631 91662 51608 12870 75061 44081 55657 34207
 09962 36417 62180 33141 99371 20610 51275 08772 40373 83995

 24072 28041 41271 83738 37015 02192 58153 02790 53311 20275
 44907 10266 85569 42166 93556 45574 11879 92841 69492 22751
 35924 35543 52956 04503 59434 30453 91160 86733 66301 44726
 88317

MESSAGE NO. 26

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
X	S		5/1 1210				TRANSCRIBED FROM ORIGINAL

GROUPS 13

FOR GENERAL GALLINA. I HAVE GIVEN ORDERS TO CEASE RESISTANCE.

GENERAL BERGINZOLI. 18.

MESSAGE NO. 27

WIRELESS INTELLIGENCE SERVICE

W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:						
CQ	X		5/1 1230				TRANSCRIBED FROM ORIGINAL

GROUPS 47

56789 22805 31046 51021 30738 39026 24642 78968 66188 42518
66151 45355 32399 35062 01897 10586 40462 02400 56912 57146
95948 73602 53544 13945 73843 65202 18406 72170 97750 09597
70108 18247 53423 18805 92398 06089 90818 47758 85865 33971
75938 83991 08258 89110 57869 37845 12396

MESSAGE NO. 28

WIRELESS INTELLIGENCE SERVICE
W/T INTERCEPT

W/T STATION		FREQUENCY	DATE & TIME	TYPE OF SIGNAL	SIGNALS STRENGTH	GONIOMETRIC FIX	REMARKS
TO:	FROM:		5/1 1230				TRANSCRIBED FROM ORIGINAL
X	Q						

GROUPS 21

12345 52487 63198 61691 78601 86447 18244 72350 47851 09597

15600 43783 78345 47196 49230 87871 00154 85903 90641 92132

51777

MESSAGE NO. 29

APPENDIX "A"

MESSAGE PRINT										PAGE	1
MESSAGE NO. 01 TO Y EPIM X DATE AND TIME 11 0900 GROUPS 027											
01 A 78001	60730	70769	85760	91790	11228	73928	65404	05744	50524		
01 B 78007	09597	84359	22385	12393	78565	32842	75017	62630	71764		
01 C 40092	33739	75938	69713	19298	08276	89338					

MESSAGE NO. 02 TO X FROM Y DATE AND TIME 11 0930 GROUPS 026

02 A 34567	60730	74769	84260	03391	18187	52608	65464	17243	64171
02 B 07778	09597	48828	00755	53504	79786	97224	06828	90818	47758
02 C 84147	31012	75938	79319	69898	42339				

MESSAGE PRINT

PAGE 3

MESSAGE NO. 03 TO X FROM Y DATE AND TIME 11 1100 GROUPS 029

03 A 23456	51747	33040	45035	92588	93926	02329	56912	57146	73077
03 B 56769	67046	94811	51690	43998	23359	04198	80160	09597	19716
03 C 38488	39968	26233	15224	21026	14932	04830	92822	18800	

MESSAGE NO. 04 TO 0 FROM N DATE AND TIME 11 1200 GROUPS 072

04 A 00000	21388	75980	09987	18562	54198	11084	46613	11533	42010
04 B 73917	31834	77584	25231	53285	88416	00894	34207	09962	55107
04 C 00510	94490	43118	28374	10746	36417	62180	44245	55171	39375
04 D 98051	90702	26242	84663	85047	90709	26240	44842	55135	42507
04 E 93162	61012	08101	22712	33316	71296	65938	22762	33338	47937
04 F 75972	22900	56030	84258	50890	09751	47309	53375	30951	59811
04 G 50244	96899	07317	72856	36254	50495	35184	40023	48499	99003
04 H 74415	11805								

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MESSAGE NO. 05 TO CO FROM X DATE AND TIME 11 1200 GROUPS 081

05 A 67890	85486	47842	72346	65464	70505	29830	87014	09597	71500
05 B 04932	97336	86649	90441	39903	49020	71683	52245	95650	75938
05 C 06160	08357	23453	48538	81390	02576	99476	53296	65187	01785
05 D 36730	27130	81966	40334	41596	62200	13486	20413	54299	46827
05 F 27509	08884	34096	68086	35763	51971	17318	14421	64417	12223
05 F 47187	15415	47831	74294	63677	07102	37759	33428	58806	74165
05 G 00369	77177	75296	56788	59874	21793	72055	51552	40147	10058
05 H 24017	93636	26300	34722	08346	28735	36404	04985	64758	39284
05 I 96522									

MESSAGE NO. 06 TO Y FROM X DATE AND TIME 11 1700 GROUPS 034											
06 A 12345	79790	06707	10217	63743	40357	60398	11887	47678	55827		
06 B 51709	95294	75938	26264	42279	05420	42644	76095	54808	08066		
06 C 43865	38400	68997	36730	41301	30513	40235	79296	23341	95497		
06 D 41487	60109	56671	75931								

MESSAGE NO. 07 TO 0 FROM A DATE AND TIME 21 1200 GROUPS 099

07 A 00000	21388	75980	44010	88488	04010	80086	89054	39823	79278
07 B 26590	39940	43131	83413	41401	89989	55587	59811	50244	85833
07 C 54220	08686	18073	31834	77584	25231	53285	58327	02484	24687
07 D 66120	33992	00312	24103	53463	44217	99232	61012	08101	22710
07 F 33314	71296	65938	22713	33316	85330	02361	39375	98051	90742
07 F 26217	84663	85047	90762	26212	36011	92403	14384	54683	06696
07 G 74423	95398	39231	23096	32993	50602	86357	98842	55747	00243
07 H 55983	08718	92949	94490	43118	00677	45747	79769	18059	08737
07 I 71120	42084	15901	42462	93639	39286	19584	68115	02849	24021
07 J 63529	19266	83498	30453	91160	86733	66301	44710	88393	

MESSAGE NO. 08 TO CQ FROM X DATE AND TIME 21 1200 GROUPS 110

08 A 34567	83185	93757	32758	87550	31934	14969	29692	23363	60274
08 B 81885	09597	56195	88927	00084	83234	18783	08863	78992	00915
08 C 01348	09118	75938	24194	08438	05789	88902	96446	51788	31508
08 D 44590	76924	61728	36730	74908	69899	40415	22223	57276	57896
08 E 20323	28133	46827	27509	08884	34096	88868	66886	95886	45027
08 F 87152	04412	12133	11021	15415	47831	74200	63686	61738	80503
08 G 26026	53883	55341	03734	57191	08894	56788	81671	00454	16951
08 H 68942	54137	54707	47383	97777	17927	01109	08346	52660	69815
08 I 94749	42416	52566	19857	13846	32538	49485	89015	72296	28563
08 J 89954	80941	85636	26488	22813	44911	25161	35910	62200	78968
08 K 40436	59777	97021	00194	08563	02651	88039	15573	76585	16901

MESSAGE NO. 09 TO X FROM Y DATE AND TIME 21 1900 GROUPS 023

09 A 45678	27678	86657	85127	09743	50429	52304	42160	62278	10915
09 B 35347	89450	72296	49146	98213	25433	01091	92472	67275	70753
09 C 76254	77776	68076							

MESSAGE NO. 10 TO P FROM Q DATE AND TIME 31 1100 GROUPS 036

10 A 00000	47039	47124	87057	81440	59500	37134	40452	95726	22773
10 B 33306	22772	33306	43769	22367	30912	23938	92842	45442	63306
10 C 18447	00203	55463	89546	03256	62701	93387	47957	56542	52461
10 D 35134	63029	00598	93272	62725	11364				

MESSAGE NO. 11 TO 0 FROM N DATE AND TIME 31 1200 GROUPS 038

11 A 00000	21388	75080	09987	18562	91842	97538	17722	64318	33230
11 B 00454	34039	68539	09612	57916	79479	95167	20190	55088	76089
11 C 28079	47545	19419	63281	63442	81194	25979	32175	10780	39412
11 D 65663	80494	85667	40023	48490	99003	74415	11863		

MESSAGE NO. 12 TO CQ FROM X DATE AND TIME 31 1200 GROUPS 043

12 A 23456	88476	26633	34123	40178	62293	83786	64990	78893	89717
12 B 38014	02400	56912	57155	47135	70400	87569	84180	00854	12944
12 C 18406	34459	79225	09597	73316	05660	16641	31186	37132	26961
12 D 65220	60869	71596	65982	75938	45328	08438	11367	53532	99303
12 E 10830	02314	75658							

MESSAGE NO. 13 TO Y FROM X DATE AND TIME 31 1300 GROUPS 024

13 A 56789	77418	56912	55401	23130	05042	22899	08618	97104	09620
13 B 49527	95207	50656	08547	09597	81528	74554	53504	92227	65071
13 C 32860	99163	90656	15734						

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MESSAGE NO. 14 TO Q FROM X DATE AND TIME 31 1600 GROUPS 088

14 A 67890	82825	75938	03447	14724	18774	59512	55925	78320	76911
14 B 41828	89803	65060	70915	36730	31382	03546	40424	43631	73327
14 C 81818	20387	68171	69152	31762	08884	86724	06233	88907	72116
14 D 45883	19701	50827	27298	16468	59362	47831	45300	12829	92523
14 E 02090	82206	45042	26325	04697	05236	92941	56788	13846	79249
14 F 58757	16784	41738	31940	17632	78394	94186	49689	08346	52660
14 G 18029	98855	08999	14665	99640	46021	10956	60770	17815	72296
14 H 05306	95232	07828	53760	91315	49149	05595	45609	73039	30727
14 I 78968	90194	07645	66919	21177	60802	32317	20881		

MESSAGE NO. 15 TO X FROM Q DATE AND TIME 31 1730 GROUPS 048

15 A 12345	93205	29567	49097	61498	79034	51357	57180	20323	23570
15 B 81265	59019	08884	34951	35339	11080	39132	97767	91140	04594
15 C 39477	99025	85071	47831	22198	55249	15117	43616	26038	31023
15 D 82412	00853	89695	17876	56788	32008	20530	35625	01877	90742
15 E 49854	49894	38560	43563	52956	28816	08346	96517		

MESSAGE NO. 16 TO X FROM Q DATE AND TIME 41 0630 GROUPS 035

16 A 23456	71390	30934	45914	31563	01839	26488	36266	48201	02260
16 B 76842	33636	78968	74472	23223	19621	87995	19234	20686	45136
16 C 74412	24455	86493	56912	74309	91669	69083	79291	73568	28854
16 D 75700	22645	05583	90584	64880					

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MESSAGE NO. 17 TO CO FROM X DATE AND TIME 41 1200 GROUPS 097

17 A 45678	06788	67332	09839	20013	09597	92628	58839	43662	22897
17 B 17048	60039	01655	84730	74917	69126	75938	25178	96522	43051
17 C 15871	31467	17429	93788	14997	65187	19066	36730	19431	89180
17 D 02514	26776	14358	22459	35357	34441	09782	34989	08884	52103
17 E 39614	39270	08245	94260	10431	48702	12214	83552	52147	47831
17 F 67610	63497	14594	75579	89892	12916	97446	04794	72325	25204
17 G 56788	07385	83892	75765	45195	72085	49728	24022	50062	27248
17 H 95594	08346	04073	68877	30482	96447	52566	86992	41511	99871
17 I 29548	17648	72296	57638	93647	68574	08687	17014	39374	56639
17 J 22602	40914	70213	78968	32423	90932	75623			

MESSAGE NO. 18 TO 0 FROM N DATE AND TIME 41 1200 GROUPS 086

18 A 00000	21388	75980	74006	15426	64834	89020	31384	99398	08718
18 B 92949	94457	43192	91850	90213	58594	30248	28807	49010	23147
18 C 97949	25972	53084	29734	16187	26103	43776	54198	11084	03512
18 D 93107	98350	30353	31834	77584	98528	95389	33258	41785	91152
18 E 67922	44018	88484	11148	10253	37201	66039	83763	89077	67272
18 F 69437	99373	33908	44010	88488	78207	06423	82065	69523	37234
18 G 66155	10512	22133	79278	26590	39940	43131	30481	05164	33922
18 H 22954	84315	44550	23308	67045	18168	55008	76528	10566	49364
18 I 97937	40023	48499	99003	77415	11860				

MESSAGE NO. 19 TO X FROM O DATE AND TIME 41 1630 GROUPS 029

19 A 56789	06441	89418	91468	84355	75498	82206	07408	08577	57290
19 B 10435	52639	56788	78449	53531	15104	39065	54446	18307	59348
19 C 74876	39324	00716	08346	62087	24802	13109	01136	73214	

MESSAGE NO. 20 TO X FROM S DATE AND TIME 41 1700 GROUPS 081

20 A 89012	13667	74422	09942	61114	58774	78168	02576	07551	43865
20 B 76924	61728	36730	16028	66495	24853	84149	09689	22683	20323
20 C 21245	29739	47022	08884	82071	31613	79059	43139	50007	07484
20 D 07101	27078	20218	92134	47831	18576	49284	58574	72333	44305
20 E 02095	97571	99387	10260	25204	56788	63375	98430	19149	02646
20 F 56690	31931	20409	72019	39243	82716	08346	49859	70204	83821
20 G 49780	44138	57924	22564	47562	62651	91786	72296	10144	63305
20 H 60912	01910	26488	23020	67596	72691	69334	59050	03458	78968
20 I 34933									

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MESSAGE NO. 21 TO S FROM X DATE AND TIME 41 1830 GROUPS 034

21 A 78901	38482	97787	01247	54761	40195	91932	49674	73800	27054
21 B 16174	02063	08346	30359	25401	57776	44284	33053	42160	55690
21 C 42953	60245	02579	72296	05225	92627	10409	01091	92472	73877
21 D 77612	60934	56456	68146						

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MESSAGE NO. 22 TO X FROM S DATE AND TIME 51 0700 GROUPS 077

22 A 67890	60730	74769	08760	03391	18187	52608	65464	71543	87203
22 B 79225	09597	82140	45666	02756	84284	31450	97241	90818	59426
22 C 32338	17817	75938	17283	97533	42961	04438	25035	52867	10494
22 D 51954	17419	10857	36730	18954	03645	31439	84149	09689	49017
22 E 20404	09860	31893	89332	08884	02142	95240	51771	46489	23198
22 F 70621	79538	63421	27801	75656	47831	98887	63596	35519	25954
22 G 40257	53883	39073	75669	05236	72911	56788	69119	99501	43804
22 H 90106	67638	65837	18061	52002	28044	73169			

MESSAGE NO. 23 TO S FROM X DATE AND TIME 51 0730 GROUPS 048

23 A 12345	86714	66802	86317	82621	90981	52159	75938	48550	08438
23 B 45193	22732	56854	02495	19769	78117	65961	41821	36730	56164
23 C 95398	49245	48749	34158	61477	07169	90806	19054	58938	08884
23 D 06809	80402	50763	38802	13359	87186	35420	86088	54569	81059
23 E 47831	30457	39661	89113	96633	02599	82044	97857		

MESSAGE NO. 24 TO X FROM S DATE AND TIME 51 0830 GROUPS 062

24 A 34567	09659	08346	24805	28735	36404	04985	39284	52566	11297
24 B 78420	30525	62677	85249	72296	74621	06765	88821	89609	02095
24 C 21802	56639	03217	78968	59159	78968	48188	28769	00719	00013
24 D 42813	09082	17410	35872	72943	12725	56912	22897	70210	08694
24 E 52962	96934	67027	70558	16312	49097	12685	09597	19627	27004
24 F 22057	07152	11901	11887	66802	82621	90981	52159	75938	64071
24 G 48550	42274								

MESSAGE NO. 25 TO CC FROM X DATE AND TIME 51 1200 GROUPS 091

25 A 23456	83185	93757	33758	87550	50241	67713	14676	96743	83197
25 B 33083	09597	82140	45666	02756	84284	31450	97241	47116	34577
25 C 89082	04543	75938	97686	56422	92853	88908	78320	64675	22322
25 D 65604	56101	63601	36730	79543	73187	19968	44143	30747	84730
25 E 00594	56608	19636	41108	08884	34906	80402	04960	51971	12755
25 F 59869	26246	80022	97715	95764	47831	45435	40196	26419	80503
25 G 74878	26631	88157	90221	05317	02642	56788	28462	48531	93195
25 H 08232	56546	14266	49894	39181	55307	79983	08346	52561	08847
25 I 27561	07965	52485	42160	39425	58450	78896	02533	12276	72296

25 J 49371

MESSAGE NO. 26 TO 0 FROM N DATE AND TIME 51 1200 GROUPS 081

26 A 00000	21388	75980	06957	12540	22288	60115	55305	00685	16057
26 B 74530	22248	60115	20361	17114	18904	54478	63945	63933	73249
26 C 91816	39490	43441	29972	54088	25552	16240	77802	16435	23308
26 D 67045	47993	11631	91662	51608	12870	75061	44081	55657	34207
26 E 09962	36417	62180	33141	99371	20610	51275	08772	40373	83995
26 F 24072	28041	41271	83738	37015	02192	58153	02790	53311	20275
26 G 44907	10266	85569	42166	93556	45574	11879	92841	69492	22751
26 H 35924	35543	52956	04503	59434	30453	91160	86733	66301	44726
26 I 88317									

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MESSAGE NO. 28 TO CQ FROM X DATE AND TIME 51 1230 GROUPS 047

28 A 56789	22805	31046	51021	30738	39026	24642	78968	66188	42518
28 R 66151	45355	32399	35062	01897	10586	40462	02400	56912	57146
28 C 95948	73602	53544	13945	73843	65202	18406	72170	97750	09597
28 D 70108	18247	53423	18805	92398	06089	90818	47758	85865	33971
28 E 75938	83991	08258	89110	57869	37845	12396			

MESSAGE NO. 29 TO X FROM Q DATE AND TIME 51 1230 GROUPS 021

29 A 12345 52487 63198 61691 78601 86447 18244 72350 47851 09597

29 B 15600 43783 78345 47196 49230 87871 00154 85903 90641 92132

29 C 51777

MESSAGE INDEX

04 A				00000	21388	75980	09987	18562
07 A				00000	21388	75980	44010	88488
10 A				00000	47039	47124	87057	81440
11 A				00000	21388	75980	09987	18562
18 A				00000	21388	75980	74006	15426
26 A				00000	21388	75980	06957	12540
24 C	78968	48188	28769	00719	00013	42813	09082	17410
08 B	81885	09597	56195	88927	00084	83234	18783	08863
29 B	78345	47196	49230	87871	00154	85903	90641	92132
08 K	78968	40436	59777	97021	00194	08563	02651	88039
10 C	92842	45442	63306	18447	00203	55463	89546	03256
07 G	50602	86357	98842	55747	00243	55983	08718	92949
07 D	02484	24687	66120	33992	00312	24103	53463	44217
05 G	37759	33428	58806	74165	00369	77177	75296	56788
08 G	57191	08894	56788	81671	00454	16951	68942	54137
11 A	97538	17722	64318	33230	00454	39039	68539	09612
04 C	00894	34207	09962	55107	00510	94490	43118	28374
25 E	19968	44143	30747	84730	00594	56608	19636	41108
10 O	56542	52461	35134	63029	00598	93272	62725	11364
07 H	08718	92949	94490	43118	00677	45747	79769	18059
								08737

APPENDIX "B"

26 A	12540	22288	60115	55305	00685	16057	74530	22248	60115
19 C	18307	59348	74876	39324	00716	08346	62087	24802	13109
24 C	59159	78968	48188	28769	00719	00013	42813	09082	17410
02 B	64171	07778	09597	48828	00755	53504	79786	97224	06828
15 D	43616	26038	31023	82412	00853	89695	17876	56788	32008
12 B	47135	70400	87569	84180	00854	12944	18406	34459	79225
04 B	77584	25231	53285	88416	00894	34207	09962	55107	00510
08 B	83234	18783	08863	78992	00915	01348	09118	75938	24194
09 B	72296	49146	98213	25433	01091	92472	67275	70753	76254
21 C	72296	05225	92627	10409	01091	92472	73877	77612	60934
08 H	54707	47383	97777	17927	01109	08346	52660	69815	94749
19 C	08346	62087	24802	13109	01136	73214			
21 A		78901	38482	97787	01247	54761	40195	91932	49674
08 C	18783	08863	78992	00915	01348	09118	75938	24194	08438
17 B	43662	22897	17048	60039	01655	84734	74917	69126	75938
05 C	02576	99476	53296	65187	01785	36730	27130	81966	40334
16 A	71390	30934	45914	31563	01839	26488	36266	48201	02260
15 D	56788	32008	20530	35625	01877	90742	49854	49894	38560
28 B	66151	45355	32399	35062	01897	10586	40462	02400	56912

20 H	72296	10144	63305	60912	01910	26488	23020	67596	72691
21 B	49674	73800	27054	16174	02063	08346	30359	25401	57776
14 E	47831	45300	12829	92523	02090	82206	45042	26325	04697
20 E	49284	58574	72333	44305	02095	97571	99387	10260	25204
24 B	74621	06765	88821	89609	02095	21802	56639	03217	78968
22 F	09860	31893	89332	08884	02142	95240	51771	46489	23198
26 F	28041	41271	83738	37015	02192	58153	02790	53311	20275
16 A	01839	26488	36266	48201	02260	76842	33636	78968	74472
12 E	11367	53532	99303	10830	02314	75658			
03 A	33040	45035	92588	93926	02329	56912	57146	73077	56769
07 E	65938	22713	33316	85330	02361	39375	98051	90742	26217
12 B	64990	78893	89717	38014	02400	56912	57155	47135	70400
28 B	35062	01897	10586	40462	02400	56912	57146	95948	73602
07 C	77584	25231	53285	58327	02484	24687	66120	33992	00312
23 B	08438	45193	22732	56854	02495	19769	78117	65961	41821
17 D	19066	36730	19431	89180	02514	26776	14358	22459	35357
25 I	42160	39425	58450	78896	02533	12276	72296	49371	
05 C	08357	23453	48538	81390	02576	99476	53296	65187	01785
20 A	09942	61114	58774	78168	02576	07551	43865	76924	61728
21 C	42160	55690	42953	60245	02579	72296	05225	92627	10409
23 E	30457	39661	89113	96633	02599	82044	97857		

25 G	26631	88157	90221	05317	02642	56788	28462	48531	93195
20 E	56788	63375	98430	19149	02646	56690	31931	20409	72019
08 K	59777	97021	00194	08563	02651	88039	15573	76585	16901
22 R	79225	09597	82140	45666	02756	84284	31450	97241	90818
25 R	33083	09597	82140	45666	02756	84284	31450	97241	47116
26 F	83738	37015	02192	58153	02790	53311	20275	44907	10266
07 I	93639	39286	19584	68115	02849	24021	63529	19266	83498
24 C	89609	02095	21802	56639	03217	78968	59159	78968	48188
10 C	18447	00203	55463	89546	03256	62701	93387	47957	56542
02 A	34567	60730	74769	84260	03391	18187	52608	65464	17243
22 A	67890	60730	74769	08760	03391	18187	52608	65464	71543
14 A		67890	82825	75938	03447	14724	18774	59512	55925
20 H	67596	72691	69334	59050	03458	78968	34933		
18 C	26103	43776	54198	11084	03512	93107	98350	30353	31834
14 B	65060	70915	36730	31382	03546	40424	43631	73327	81818
22 D	17419	10857	36730	18954	03645	31439	84149	09689	49017
08 G	80503	26026	53883	55341	03734	57191	08894	56788	81671
07 A	21388	75980	44010	88488	04010	80086	89054	39823	79278
17 H	50062	27248	95594	08346	04073	68877	30482	96447	52566

03 B 94811	51690	43998	23359	04198	80160	09597	19716	38488
08 F 66886	95886	45027	87152	04412	12133	11021	15415	47831
22 C 75938	17283	97533	42961	04438	25035	52867	10494	51954
26 H 22751	35924	35543	52956	04503	59434	30453	91160	86733
25 C 97241	47116	34577	89082	04543	75938	97686	56422	92853
15 B 11080	39132	97787	91140	04594	39477	99025	85071	47831
14 E 02090	82206	45042	26325	04697	05236	92941	56788	13846
17 F 75579	89892	12916	97446	04794	72325	25204	56788	07385
03 C 26233	15224	21026	14932	04830	92822	18800		
05 B 29830	87014	09597	71500	04932	97336	86649	90441	39903
25 E 41108	08884	34906	80402	04960	51971	12755	59869	26246
05 H 34722	08346	28735	36404	04985	64758	39284	96522	
24 A 08346	24805	28735	36404	04985	39284	52566	11297	78420
13 A 77418	56912	55401	23130	05042	22899	08618	97104	09620
18 G 26590	39940	43131	30481	05164	33922	22954	84315	44550
21 C 42953	60245	02579	72296	05225	92627	10409	01091	92472
14 E 82206	45042	26325	04697	05236	92941	56788	13846	79249
22 G 40257	53883	39073	75669	05236	72911	56788	69119	99501
14 H 10956	60770	17815	72296	05306	95232	07828	53760	91315
25 G 74878	26631	88157	90221	05317	02642	56788	28462	48531

06 B 95294	75938	26264	42279	05420	42644	76095	54808	08066
16 D 73568	28854	75700	22645	05583	90584	64880		
14 H 07828	53760	91315	49149	05595	45609	73039	30727	78968
12 C 34459	79225	09597	73316	05660	16641	31186	37132	26961
01 A 97799	11228	73928	65464	05744	50524	78007	09597	84359
08 C 09118	75938	24194	08438	05789	88902	96446	51788	31508
28 D 18247	53423	18805	92398	06089	90818	47758	85865	33971
05 C 71683	52245	95650	75938	06160	08357	23453	48538	81390
14 C 69152	31762	08884	86724	06233	88907	72116	45883	19701
18 F 33908	44010	88488	78207	06423	82065	69523	37234	66155
19 A			56789	06441	89418	91468	84355	75498
07 F 36011	92403	14384	54683	06696	74423	95398	39231	23096
06 A		12345	79790	06707	10217	63743	40357	60398
24 B 62677	85249	72296	74621	06765	88821	89609	02095	21802
17 A			45678	06788	67332	09839	20013	09597
23 D 90806	19054	58938	08884	06809	80402	50763	38802	13359
02 B 00755	53504	79786	97224	06828	90818	47758	84147	31012
26 A	00000	21388	75980	06957	12540	22288	60115	55305
20 D 79059	43139	50007	07484	07101	27078	20218	92134	47831

05 F 15415	47831	74294	63677	07102	37759	33428	58806	74165
24 F 09597	19627	27004	22057	07152	11901	11887	66802	82621
23 C 49245	48749	34158	61477	07169	90806	19054	58938	08884
04 G 30951	59811	50244	96899	07317	72856	36254	50495	35184
17 G 04794	72325	25204	56788	07385	83892	75765	45195	72085
19 A 91468	84355	75498	82206	07408	08577	57290	10435	52639
20 C 31613	79059	43139	50007	07484	07101	27078	20218	92134
20 A 61114	58774	78168	02576	07551	43865	76924	61728	36730
14 I 73039	30727	78968	90194	07645	66919	21177	60802	32317
02 B 52608	65464	17243	64171	07778	09597	48828	00755	53504
14 H 17815	72296	05306	95232	07828	53760	91315	49149	05595
25 I 08346	52561	08847	27561	07965	52485	42160	39425	58450
06 B 05420	42644	76095	54808	08066	43865	38400	68997	36730
04 E 55135	42507	93162	61012	08101	22712	33316	71296	65938
07 D 53463	44217	99232	61012	08101	22710	33314	71296	65938
25 H 56788	28462	48531	93195	08232	56546	14266	49894	39181
17 E 08884	52103	39614	39270	08245	94260	10431	48702	12214
28 E 85865	33971	75938	83991	08258	89110	57869	37845	12396
01 C 33739	75938	69713	19298	08276	89338			

05 H	24017	93636	26300	34722	08346	28735	36404	04985	64758
08 H	47383	97777	17927	01109	08346	52660	69815	94749	42416
14 F	17632	78394	94186	49689	08346	52660	18029	98855	08999
15 E	38560	43563	52956	28816	08346	96517	68877	30482	96447
17 H	24022	50062	27248	95594	08346	04073	24802	13109	01136
19 C	59348	74876	39324	00716	08346	62087	70204	83821	49780
20 F	20409	72019	39243	82716	08346	49859	25401	57776	44284
21 B	73800	27054	16174	02063	08346	30359	28735	36404	04985
24 A			34567	09659	08346	24805	08847	27561	07965
25 H	49894	39181	55307	79983	08346	52561			
05 C	52245	95650	75938	06160	08357	23453	48538	81390	02576
08 C	01348	09118	75938	24194	08438	05789	88902	96446	51788
12 D	71596	65982	75938	45328	08438	11367	53532	99303	10830
23 A	90981	52159	75938	48550	08438	45193	22732	56854	02495
13 B	09620	49527	95207	50656	08547	09597	81528	74554	53504
08 K	40436	59777	97021	00194	08563	02651	88039	15573	76585
19 A	84355	75498	82206	07408	08577	57290	10435	52639	56788
13 A	55401	23130	05042	22899	08618	97104	09620	49527	95207
07 C	59811	50244	85833	54220	08686	18073	31834	77584	25231
17 I	72296	57638	93647	68574	08687	17014	39374	56639	22602
24 D	12725	56912	22897	70210	08694	52962	96934	67027	70558
07 H	98842	55747	00243	55983	08718	92949	94490	43118	00677
18 A	64834	89020	31384	99398	08718	92949	94457	43192	91850
07 H	00677	45747	79769	18059	08737	71120	42084	15901	42462
22 A		67890	60730	74769	08760	03391	18187	52608	65464

26 F 33141	99371	20610	51275	08772	40373	83995	24072	28041
25 H 55307	79983	08346	52561	08847	27561	07965	52485	42160
08 R 88927	00084	83234	18783	08863	78992	00915	01348	09118
05 E 20413	54299	46827	27509	08884	34096	68086	35763	51971
08 F 20323	28133	46827	27509	08884	34096	88868	66886	95886
14 C 20387	68171	69152	31762	08884	86724	06233	88907	72116
15 B 20323	23570	81265	59019	08884	34951	35339	11080	39132
17 D 35357	34441	09782	34989	08884	52103	39614	39270	08245
20 C 20323	21245	29739	47022	08884	82071	31613	79059	43139
22 F 20404	09860	31893	89332	08884	02142	95240	51771	46489
23 C 07169	90806	19054	58938	08884	06809	80402	50763	38802
25 E 00594	56608	19636	41108	08884	34906	80402	04960	51971
08 G 53883	55341	03734	57191	08894	56788	81671	00454	16951
14 G 08346	52660	18029	98855	08999	14665	99640	46021	10956
24 D 28769	00719	00013	42813	09082	17410	35872	72943	12725
08 C 08863	78992	00915	01348	09118	75938	24194	08438	05789
01 B 65464	05744	50524	78007	09597	84359	22385	12393	78565
02 B 65464	17243	64171	07778	09597	48828	00755	53504	79786
03 B 43998	23359	04198	80160	09597	19716	38488	39968	26233
05 A 65464	70505	29830	87014	09597	71500	04932	97336	86649
08 B 29692	23363	60274	81885	09597	56195	88927	00084	83234
12 C 12944	18406	34459	79225	09597	73316	05660	16641	31186
13 B 49527	95207	50656	08547	09597	81528	74554	53504	92227
17 A 06788	67332	09839	20013	09597	92628	58839	43662	22897
22 B 65464	71543	87203	79225	09597	82140	45666	02756	84284
24 F 70558	16312	49097	12685	09597	19627	27004	22057	07152
25 R 14676	96743	83197	33083	09597	82140	45666	02756	84284
28 C 65202	18406	72170	97750	09597	70108	18247	53423	18805
29 A 86447	18244	72350	47851	09597	15600	43783	78345	47196

11 B 33230	00454	39039	68539	09612	57916	79479	95167	20190
13 A 05042	22899	08618	97104	09620	49527	95207	50656	08547
24 A			34567	09659	08346	24805	26735	36404
20 B 16028	66495	24853	84149	09689	22683	20323	21245	29739
22 D 18954	03645	31439	84149	09689	49017	20404	09860	31893
09 A 45678	27678	86657	85127	09743	50429	52304	42160	62278
04 F 22900	56030	84258	50890	09751	47309	53375	30951	59811
17 D 14358	22459	35357	34441	09782	34989	08884	52103	39614
17 A	45678	06788	67332	09839	20013	09597	92628	58839
22 E 84149	09689	49017	20404	09860	31893	89332	08884	02142
20 A	89012	13667	74422	09942	61114	56774	78168	02576
04 B 53285	88416	00894	34207	09962	55107	00510	94490	43118
26 E 75061	44081	55657	34207	09962	36417	62180	33141	99371
04 A	00000	21388	75980	09987	18562	54198	11084	46613
11 A	00000	21388	75980	09987	18562	91842	97538	17722
05 G 21793	72055	51552	40147	10058	24017	93636	26300	34722
20 G 47562	62651	91786	72296	10144	63305	60912	01910	26488
06 A	12345	79790	06707	10217	63743	40357	60398	11887
18 E 67922	44018	88484	11148	10253	37201	66039	83763	89077
20 E 44305	02095	97571	99387	10260	25204	56788	63375	98430
26 G 02790	53311	20275	44907	10266	85569	42166	93556	45574

21 C 02579	72296	05225	92627	10409	01091	92472	73877	77612
17 F 39614	39270	08245	94260	10431	48702	12214	83552	52147
19 H 82206	07408	08577	57290	10435	52639	56788	78449	53531
22 C 42961	04438	25035	52867	10494	51954	17419	10857	36730
18 G 82065	69523	37234	66155	10512	22133	79278	26590	39940
18 H 67045	18168	55008	76528	10566	49364	97937	40023	48499
28 H 45355	32399	35062	01897	10586	40462	02400	56912	57146
04 C 00510	94490	43118	28374	10746	36417	62180	44245	55171
11 C 63442	81194	25979	32175	10760	39412	65663	80494	85667
12 E 08438	11367	53532	99303	10830	02314	75658		
22 D 52867	10494	51954	17419	10857	36730	18954	03645	31439
09 A 50429	52304	42160	62278	10915	35347	89450	72296	49146
14 G 08999	14665	99640	46021	10956	60770	17815	72296	05306
08 F 45027	87152	04412	12133	11021	15415	47831	74200	63686
15 H 59019	08884	34951	35339	11080	39132	97787	91140	04594
04 A 75980	09987	18562	54198	11084	46613	11533	42010	73917
18 C 16187	26103	43776	54198	11084	03512	93107	98350	30353
18 E 91152	67922	44018	88484	11148	10253	37201	66039	83763
01 A 60730	74769	85760	97799	11228	73928	65464	05744	50524

24 A 36404	04985	39284	52566	11297	78420	30525	62677	85249
10 D 63029	00598	93272	62725	11364				
12 D 65982	75938	45328	08438	11367	53532	99303	10830	02314
04 A 18562	54198	11084	46613	11533	42010	73917	31834	77584
26 D 16435	23308	67045	47993	11631	91662	51608	12870	75061
04 H 40023	48499	99003	74415	11805				
18 I 40023	48499	99003	77415	11860				
11 D 40023	48499	99003	74415	11863				
26 G 85569	42166	93556	45574	11879	92841	69492	22751	35924
06 A 10217	63743	40357	60398	11887	47678	55827	51709	95294
24 F 27004	22057	07152	11901	11887	66802	82621	90981	52159
24 F 19627	27004	22057	07152	11901	11887	66802	82621	90981
08 F 95886	45027	87152	04412	12133	11021	15415	47831	74200
17 E 08245	94260	10431	48702	12214	83552	52147	47831	67610
05 E 51971	17318	14421	64417	12223	47187	15415	47831	74294
25 I 39425	58450	78896	02533	12276	72296	49371		
06 A			12345	12345	79790	06707	10217	63743
15 A			12345	12345	93205	29567	49097	61498
23 A			12345	12345	86714	66802	86317	82621
29 A			12345	12345	52487	63198	61691	78601
01 H 78007	09597	84359	22385	12393	78565	32842	75017	62630

28 E	08258	89110	57869	37845	12396			
26 A	00000	21388	75980	06957	12540	22288	60115	55305 00685
24 F	67027	70558	16312	49097	12685	09597	19627	27004 22057
24 D	09082	17410	35872	72943	12725	56912	22897	70210 08694
25 F	34906	80402	04960	51971	12755	59869	26246	80022 97715
14 D	16468	59362	47831	45300	12829	92523	02090	82206 45042
26 D	47993	11631	91662	51608	12870	75061	44081	55657 34207
17 F	63497	14594	75579	89892	12916	97446	04794	72325 25204
12 B	70400	87569	84180	00854	12944	18406	34459	79225 09597
19 C	00716	08346	62087	24802	13109	01136	73214	
23 D	06809	80402	50763	38802	13359	87186	35420	86088 54569
05 D	81966	40334	41596	62200	13486	20413	54299	46827 27509
20 A				89012	13667	74422	09942	61114 58774
08 I	94749	42416	52566	19857	13846	32538	49485	89015 72296
14 F	04697	05236	92941	56788	13846	79240	58757	16784 41738
28 C	57146	95948	73602	53544	13945	73843	65202	18406 72170
25 H	48531	93195	08232	56546	14266	49894	39181	55307 79983
17 D	19431	89180	02514	26776	14358	22459	35357	34441 09782
07 F	90762	26212	36011	92403	14384	54683	06696	74423 95398
05 E	68086	35763	51971	17318	14421	64417	12223	47187 15415

17 F 52147	47831	67610	63497	14594	75579	89892	12916	97446
14 G 52660	18029	98855	08999	14665	99640	46021	10956	60770
25 A 33758	87550	50241	67713	14676	96743	83197	33083	09597
14 A 67890	82825	75938	03447	14724	18774	59512	55925	78320
03 C 39968	26233	15224	21026	14932	04830	92822	18800	
08 A 93757	32758	87550	31934	14969	29692	23363	60274	81885
17 C 15871	31467	17429	93788	14997	65187	19066	36730	19431
19 B 52639	56788	78449	53531	15104	39065	54446	18307	59348
15 C 85071	47831	22198	55249	15117	43616	26038	31023	82412
03 C 19716	38488	39968	26233	15224	21026	14932	04830	92822
05 F 14421	64417	12223	47187	15415	47831	74294	63677	07102
08 F 87152	04412	12133	11021	15415	47831	74200	63686	61738
18 A 00000	21388	75980	74006	15426	64834	89020	31384	99398
08 K 00194	08563	02651	88039	15573	76585	16901		
29 B 18244	72350	47851	09597	15600	43783	78345	47196	49230
13 C 65071	32860	99163	90656	15734				
17 C 75938	25178	96522	43051	15871	31467	17429	93788	14997
07 I 18059	08737	71120	42084	15901	42462	93639	39286	19584
20 B 43865	76924	61728	36730	16028	66495	24853	84149	09689
26 A 22288	60115	55305	00685	16057	74530	22248	60115	20361

21 B 91932	49674	73800	27054	16174	02063	08346	30359	25401
18 C 97949	25972	53084	29734	16187	26103	43776	54198	11084
26 C 43441	29972	54088	25552	16240	77802	16435	23308	67045
24 F 52962	96934	67027	70558	16312	49097	12685	09597	19627
26 C 54088	25552	16240	77802	16435	23308	67045	47993	11631
14 D 45883	19701	50827	27298	16468	59362	47831	45300	12829
12 C 79225	09597	73316	05660	16641	31186	37132	26961	65220
14 F 56788	13846	79249	58757	16784	41738	31940	17632	78394
08 K 02651	88039	15573	76585	16901				
08 G 08894	56788	81671	00454	16951	68942	54137	54707	47383
17 I 57638	93647	68574	08687	17014	39374	56639	22602	40914
17 B 92628	58839	43662	22897	17048	60039	01655	84734	74917
26 B 74530	22248	60115	20361	17114	18904	54478	63945	63933
02 A 03391	18187	52608	65464	17243	64171	07778	09597	48828
22 C 59426	32338	17817	75938	17283	97533	42961	04438	25035
05 E 34096	68086	35763	51971	17318	14421	64417	12223	47187
24 D 00719	00013	42813	09082	17410	35872	72943	12725	56912
22 D 25035	52867	10494	51954	17419	10857	36730	18954	03645
17 C 96522	43051	15871	31467	17429	93788	14997	65187	19066

14 F 58757	16784	41738	31940	17632	78394	94186	49689	08346
17 J 86992	41511	99871	29548	17648	72296	57638	93647	68574
11 A 09987	18562	91842	97538	17722	64318	33230	00454	39039
14 G 99640	46021	10956	60770	17815	72296	05306	95232	07828
22 C 97241	90818	59426	32338	17817	75938	17283	97533	42961
15 D 31023	82412	00853	89695	17876	56788	32008	20530	35625
08 H 54137	54707	47383	97777	17927	01109	08346	52660	69815
14 G 94186	49689	08346	52660	18029	98855	08999	14665	99640
07 H 43118	00677	45747	79769	18059	08737	71120	42084	15901
22 H 43804	90106	67638	65837	18061	52002	28044	73169	
07 C 50244	85833	54220	08686	18073	31834	77584	25231	53285
18 H 84315	44550	23308	67045	18168	55008	76528	10566	49364
02 A 60730	74769	84260	03391	18187	52608	65464	17243	64171
22 A 60730	74769	08760	03391	18187	52608	65464	71543	87203
29 A 63198	61691	78601	86447	18244	72350	47851	09597	15600
28 D 72170	97750	09597	70108	18247	53423	18805	92398	06089
19 R 53531	15104	39065	54446	18307	59348	74876	39324	00716
12 C 87569	84180	00854	12944	18406	34459	79225	09597	73316
28 C 53544	13945	73843	65202	18406	72170	97750	09597	70108
10 C 23938	92842	45442	63306	18447	00203	55463	89546	03256

04 A	00000	21388	75980	09987	18562	54198	11084	46613	11533
11 A	00000	21388	75980	09987	18562	91842	97538	17722	64318
20 D	27078	20218	92134	47831	18576	49284	58574	72333	44305
14 A	82825	75938	03447	14724	18774	59512	55925	78320	76911
08 H	56195	88927	00084	83234	18783	08863	78992	00915	01348
03 C	21026	14932	04830	92822	18800				
28 D	09597	70108	18247	53423	18805	92398	06089	90818	47758
26 B	22248	60115	20361	17114	18904	54478	63945	63933	73249
22 D	51954	17419	10857	36730	18954	03645	31439	84149	09689
23 C	34158	61477	07169	90806	19054	58938	08884	06809	80402
17 C	17429	93788	14997	65187	19066	36730	19431	89180	02514
20 E	25204	56788	63375	98430	19149	02646	56690	31931	20409
16 B	74472	23223	19621	87995	19234	20686	45136	74412	24455
07 J	68115	02849	24021	63529	19266	83498	30453	91160	86733
01 C	40992	33739	75938	69713	19298	08276	89338		
11 C	55088	76089	28079	47545	19419	63281	63442	81194	25979
17 C	14997	65187	19066	36730	19431	89180	02514	26776	14358
07 I	15901	42462	93639	39286	19584	68115	02849	24021	63529
16 B	33636	78968	74472	23223	19621	87995	19234	20686	45136

24 F 16312	49097	12685	09597	19627	27004	22057	07152	11901
25 F 30747	84730	00594	56608	19636	41108	08884	34906	80402
14 D 06233	88907	72116	45883	19701	50827	27298	16468	59362
03 R 23359	04198	80160	09597	19716	38488	39968	26233	15224
23 R 45193	22732	56854	02495	19769	78117	65961	41821	36730
08 I 69815	94749	42416	52566	19857	13846	32538	49485	89015
25 D 63601	36730	79543	73187	19968	44143	30747	84730	00594
17 A 45678	06788	67332	09839	20013	09597	92628	58839	43662
11 B 09612	57916	79479	95167	20190	55088	76089	28079	47545
20 D 50007	07484	07101	27078	20218	92134	47831	18576	49284
26 F 02192	58153	02790	53311	20275	44907	10266	85569	42166
08 E 40415	22223	57276	57896	20323	28133	46827	27509	08884
15 A 61498	79034	57357	57180	20323	23570	81265	59019	08884
20 B 24853	84149	09489	22683	20323	21245	29739	47022	08884
26 B 16057	74530	22248	60115	20361	17114	18904	54478	63945
14 C 40424	43631	73327	81818	20387	68171	69152	31762	08884
22 E 31439	84149	09689	49017	20404	09860	31893	89332	08884
20 F 19149	02646	56690	31931	20409	72019	39243	82716	08346
05 D 40334	41596	62200	13486	20413	54299	46827	27509	08884
15 D 89695	17876	56788	32008	20530	35625	01877	90742	49854

26 E	36417	62180	33141	99371	20610	51275	08772	40373	83995
16 B	23223	19621	87995	19234	20686	45136	74412	24455	86493
14 I	66919	21177	60802	32317	20881				
03 C	38488	39968	26233	15224	21026	14932	04830	92822	18800
14 I	78968	90194	07645	66919	21177	60602	32317	20881	
20 C	84149	09689	22683	20323	21245	29739	47022	08884	82071
04 A				00000	21388	75080	09987	18562	54198
07 A				00000	21388	75980	44010	88488	04010
11 A				00000	21388	75980	09987	18562	91842
18 A				00000	21388	75980	74006	15426	64834
26 A				00000	21388	75980	06957	12540	22288
05 G	77177	75296	56788	59874	21793	72055	51552	40147	10058
24 C	06765	88821	89609	02095	21802	56639	03217	78968	59159
24 F	12685	09597	19627	27004	22057	07152	11901	11887	66802
18 G	69523	37234	66155	10512	22133	79278	26590	39940	43131
15 C	39477	99025	85071	47831	22198	55249	15117	43616	26038
08 D	36730	74908	69899	40415	22223	57276	57896	20323	28133
26 B	55305	00685	16057	74530	22248	60115	20361	17114	18904
26 A	21388	75980	06957	12540	22288	60115	55305	00685	16057
25 C	92853	88908	78320	64675	22322	65604	56101	63601	36730
10 B	33306	22772	33306	43769	22367	30912	23938	92842	45442

01 R 50524	78007	09597	84359	22385	12393	78565	32842	75017
17 D 89180	02514	26776	14358	22459	35357	34441	09782	34989
20 G 83821	49780	44138	57924	22564	47562	62651	91786	72296
17 J 08687	17014	39374	56639	22602	40914	70213	78968	32423
16 D 79291	73568	28854	75700	22645	05583	90584	64880	
20 R 66495	24853	84149	09689	22683	20323	21245	29739	47022
07 D 44217	99232	61012	08101	22710	33314	71296	65938	22713
04 E 42507	93162	61012	08101	22712	33316	71296	65938	22762
07 E 22710	33314	71296	65938	22713	33316	85330	02361	39375
23 R 75938	48550	08438	45193	22732	56654	02495	19769	78117
26 G 45574	11879	92841	69492	22751	35924	35543	52956	04503
04 E 22712	33316	71296	65938	22762	33338	47937	75972	22900
10 R 40452	95726	22773	33306	22772	33306	43769	22367	30912
10 A 59500	37134	40452	95726	22773	33306	22772	33306	43769
28 A			56789	22805	31046	51021	30738	39026
08 J 89954	80941	85636	26488	22813	44911	25161	35910	62200
17 A 09597	92628	58839	43662	22897	17048	60039	01655	84734
24 D 35872	72943	12725	56912	22897	70210	08694	52962	96934
13 A 56912	55401	23130	05042	22899	08618	97104	09620	49527

04 F 22762	33338	47937	75972	22900	56030	84258	50890	09751
18 H 43131	30481	05164	33922	22954	84315	44550	23308	67045
20 H 63305	60912	01910	26488	23020	67596	72691	69334	59050
07 G 06696	74423	95398	39231	23096	32993	50602	86357	98842
13 A 56789	77418	56912	55401	23130	05042	22899	08618	97104
18 H 58594	30248	28807	49010	23147	97949	25972	53084	29734
22 E 02142	95240	51771	46489	23198	70621	79538	63421	27801
16 B 76842	33636	78968	74472	23223	19621	87995	19234	20686
18 H 33922	22954	84315	44550	23308	67045	18168	55008	76528
26 C 25552	16240	77802	16435	23308	67045	47993	11631	91662
06 C 41301	30513	40235	79296	23341	95497	41487	60109	56671
03 R 67046	94811	51690	43998	23359	04198	80160	09597	19716
08 A 87550	31934	14969	29692	23363	60274	81885	09597	56195
05 C 95650	75938	06160	08357	23453	48538	81390	02576	99476
03 A				23456	51747	33040	45035	92588
12 A				23456	88476	26633	34123	40178
16 A				23456	71390	30934	45914	31563
25 A				23456	83185	93757	33758	87550
15 A 79034	57357	57180	20323	23570	81265	59019	08884	34951
10 B 33306	43769	22367	30912	23938	92842	45442	63306	18447
05 H 72055	51552	40147	10058	24017	93636	26300	34722	08346

07 I 39286	19584	68115	02849	24021	63529	19266	83498	30453
17 G 75765	45195	72085	49728	24022	50062	27248	95594	08346
26 F 51275	08772	40373	83995	24072	28041	41271	83738	37015
07 D 24687	66120	33992	00312	24103	53463	44217	99232	61012
08 C 00915	01348	09118	75938	24194	08438	05789	88902	96446
16 C 19234	20686	45136	74412	24455	86493	56912	74309	91669
28 A 31046	51021	30738	39026	24642	78968	66188	42518	66151
07 C 25231	53285	58327	02484	24687	66120	33992	00312	24103
19 C 39324	00716	08346	62087	24802	13109	01136	73214	
24 A	34567	09659	08346	24805	28735	36404	04085	39284
20 B 61728	36730	16028	66495	24853	84149	09689	22683	20323
22 C 17283	97533	42961	04438	25035	52867	10494	51954	17419
08 J 85636	26488	22813	44911	25161	35910	62200	78968	40436
17 B 84734	74917	69126	75938	25178	96522	43051	15871	31467
17 F 12916	97446	04794	72325	25204	56788	07385	83892	75765
20 E 02095	97571	99387	10260	25204	56788	63375	98430	19149
04 B 42010	73917	31834	77584	25231	53285	88416	00894	34207
07 C 08686	18073	31834	77584	25231	53285	58327	02484	24687
21 B 16174	02063	08346	30359	25401	57776	44284	33053	42160
09 B 89450	72296	49146	98213	25433	01091	92472	67275	70753

26 C 39490	43441	29972	54088	25552	16240	77802	16435	23308
22 F 47831	98887	63596	35519	25954	40257	53883	39073	75669
18 C 28807	49010	23147	97949	25972	53084	29734	16187	26103
11 C 19419	63281	63442	81194	25979	32175	10780	39412	65663
08 G 74200	63686	61738	80503	26026	53883	55341	03734	57191
15 C 22198	55249	15117	43616	26038	31023	82412	00853	89695
18 C 25972	53084	29734	16167	26103	43776	54198	11084	03512
07 F 26217	84663	85047	90762	26212	36011	92403	14384	54683
07 F 02361	39375	98051	90742	26217	84663	85047	90762	26212
03 C 09597	19716	38488	39968	26233	15224	21026	14932	04830
04 D 26242	84663	85047	90709	26240	44842	55135	42507	93162
04 D 55171	39375	98051	90702	26242	84663	85047	90709	26240
25 F 04960	51971	12755	59869	26246	80022	97715	95764	47831
06 B 55827	51709	95294	75938	26264	42279	05420	42644	76095
05 H 40147	10058	24017	93636	26300	34722	08346	28735	36404
14 E 92523	02090	82206	45042	26325	04697	05236	92941	56788
25 F 95764	47831	45435	40196	26419	80503	74878	26631	88157
08 J 28563	89954	80941	85636	26488	22813	44911	25161	35910
16 A 30934	45914	31563	01839	26488	36266	48201	02260	76842
20 H 10144	63305	60912	01910	26488	23020	67596	72691	69334

07 H 80086	89054	39823	79278	26590	39940	43131	83413	41401
18 G 66155	10512	22133	79278	26590	39940	43131	30481	05164
25 G 40196	26419	80503	74878	26631	88157	90221	05317	02642
12 A		23456	88476	26633	34123	40178	62293	83786
17 D 36730	19431	89180	02514	26776	14358	22459	35357	34441
12 C 05660	16641	31186	37132	26961	65220	60869	71596	65982
24 E 49097	12685	09597	19627	27004	22057	07152	11901	11887
21 A 40195	91932	49674	73800	27054	16174	02063	08346	30359
20 D 43139	50007	07484	07101	27078	20218	92134	47831	18576
05 D 53296	65187	01785	36730	27130	81966	40334	41596	62200
17 G 72085	49728	24022	50062	27248	95594	08346	04073	68877
14 D 72116	45883	19701	50827	27298	16468	59362	47831	45300
05 E 13486	20413	54299	46827	27509	08884	34096	68086	35763
08 E 57696	20323	28133	46827	27509	08884	34096	88868	66886
25 I 79983	08346	52561	08847	27561	07965	52485	42160	39425
09 A			45678	27678	86657	85127	09743	50429
22 F 23198	70621	79538	63421	27801	75656	47831	98887	63596
26 F 08772	40373	83995	24072	28041	41271	83738	37015	02192
22 H 67638	65837	18061	52002	28044	73169			

11 C 95167	20190	55088	76080	28079	47545	19419	63281	63442
08 E 22223	57276	57896	20323	28133	46827	27509	08884	34096
04 C 55107	00510	94490	43118	28374	10746	36417	62180	44245
25 G 90221	05317	02642	56788	28462	48531	93195	08232	56546
08 I 32538	49485	89015	72296	28563	89954	80941	85636	26488
05 H 93636	26300	34722	08346	28735	36404	04985	64758	39284
24 A 34567	09659	08346	24805	28735	36404	04985	39284	52566
24 C 78968	59159	78968	48188	28769	00719	00013	42813	09082
18 B 91850	90213	58594	30248	28807	49010	23147	97949	25972
15 E 49894	38560	43563	52956	28816	08346	96517		
16 C 91669	69083	79291	73568	28854	75700	22645	05583	90584
17 I 52566	86992	41511	99871	29548	17648	72296	57638	93647
15 A		12345	93205	29567	49097	61498	79034	57357
08 A 32758	87550	31934	14969	29692	23363	60274	81885	09597
18 C 23147	97949	25972	53084	29734	16187	26103	43776	54198
20 C 09689	22683	20323	21245	29739	47022	08884	82071	31613
05 A 47842	72346	65464	70505	29830	87014	09597	71500	04932
26 C 73249	91816	39490	43441	29972	54088	25552	16240	77802
18 B 43192	91850	90213	58594	30248	28807	49010	23147	97949

1R D 11084	03512	93107	98350	30353	31834	77584	98528	95389
21 H 27054	16174	02063	08346	30359	25401	57776	44284	33053
07 J 24021	63529	19266	83498	30453	91160	86733	66301	44710
26 H 35543	52956	04503	59434	30453	91160	86733	66301	44726
23 E 86088	54569	81059	47831	30457	39661	89113	96633	02599
18 G 79278	26590	39940	43131	30481	05164	33922	22954	84315
17 H 95594	08346	04073	68877	30482	96447	52566	86992	41511
06 C 38400	68997	36730	41301	30513	40235	79296	23341	95497
24 H 39284	52566	11297	78420	30525	62677	85249	72296	74621
14 H 49149	05595	45609	73039	30727	78968	90194	07645	66919
28 A 56789	22805	31046	51021	30738	39026	24642	78968	66188
25 D 79543	73187	19968	44143	30747	84730	00594	56608	19636
10 H 22772	33306	43769	22367	30912	23938	92842	45442	63306
16 A		23456	71390	30934	45914	31563	01839	26488
04 F 50890	09751	47309	53375	30951	59811	50244	96899	07317
02 C 06828	90818	47758	84147	31012	75938	79319	69898	42339
15 C 55249	15117	43616	26038	31023	82412	00853	89695	17876
28 A		56789	22805	31046	51021	30738	39026	24642
12 C 09597	73316	05660	16641	31186	37132	26961	65220	60869
14 H 89803	65060	70915	36730	31382	03546	40424	43631	73327

1A A 74006	15426	64834	89020	31384	99398	06718	92949	94457
22 D 10857	36730	18954	03645	31439	84149	09689	49017	20404
22 R 82140	45666	02756	84284	31450	97241	90818	59426	32338
25 R 82140	45666	02756	84284	31450	97241	47116	34577	89082
17 C 25178	96522	43051	15871	31467	17429	93788	14997	65187
08 C 05789	88902	96446	51788	31508	44590	76924	61728	36730
16 A 23456	71390	30934	45914	31563	01839	26488	36266	48201
20 C 29739	47022	08884	82071	31613	79059	43139	50007	07484
14 C 81818	20387	68171	69152	31762	08884	86724	06233	88907
04 R 46613	11533	42010	73917	31834	77584	25231	53285	88416
07 C 85833	54220	08686	18073	31834	77584	25231	53285	58327
18 D 03512	93107	98350	30353	31834	77584	98528	95389	33258
22 E 09689	49017	20404	09860	31893	89332	08884	02142	95240
20 F 98430	19144	02646	56690	31931	20409	72019	39243	82716
08 A 83185	93757	32758	87550	31934	14969	29692	23363	60274
14 F 79249	58757	16784	41738	31940	17632	78394	94186	49689
15 D 00853	89695	17876	56788	32008	20530	35625	01877	90742
11 C 63281	63442	81194	25979	32175	10780	39412	65663	80494
14 I 07645	66919	21177	60802	32317	20881			
22 C 31450	97241	90818	59426	32338	17817	75938	17283	97533
28 R 66188	42518	66151	45355	32399	35062	01897	10586	40462

17 J	22602	40914	70213	78968	32423	90932	75623		
08 I	42416	52566	19857	13846	32538	49485	89015	72296	28563
08 A		34567	83185	93757	32758	87550	31934	14969	29692
01 B	84359	22385	12393	78565	32842	75017	62630	71764	40992
13 C	74554	53504	92227	65071	32860	99163	90656	15734	
07 G	74423	95398	39231	23096	32993	50602	86357	98842	55747
03 A			23456	51747	33040	45035	92588	93926	02329
21 B	30359	25401	57776	44284	33053	42160	55690	42953	60245
25 B	67713	14676	96743	83197	33083	09597	82140	45666	02756
26 F	34207	09962	36417	62180	33141	99371	20610	51275	08772
11 A	91842	97538	17722	64318	33230	00454	39039	68539	09612
18 D	31834	77584	98528	95389	33258	41785	91152	67922	44018
10 B	37134	40452	95726	22773	33306	22772	33306	43769	22367
10 B	95726	22773	33306	22772	33306	43769	22367	30912	23938
07 E	99232	61012	08101	22710	33314	71296	65938	22713	33316
04 E	93162	61012	08101	22712	33316	71296	65938	22762	33338
07 E	33314	71296	65938	22713	33316	85330	02361	39375	98051
04 E	33316	71296	65938	22762	33338	47937	75972	22900	56030
05 F	74294	63677	07102	37759	33428	58806	74165	00369	77177
16 B	36266	48201	02260	76842	33636	78968	74472	23223	19621

01 C 75017	62630	71764	40992	33739	75938	69713	19298	08276
25 A	23456	83185	93757	33758	87550	50241	67713	14676
18 F 89077	67272	69437	99373	33908	44010	88488	78207	06423
18 G 39940	43131	30481	05164	33922	22954	84315	44550	23308
28 D 06089	90818	47758	85865	33971	75938	83991	08258	89110
07 D 58327	02484	24687	66120	33992	00312	24103	53463	44217
05 E 54299	46827	27509	08884	34096	68086	35763	51971	17318
08 E 28133	46827	27509	08884	34096	88868	66886	95886	45027
12 A	23456	88476	26633	34123	40178	62293	83786	64990
23 C 56164	95398	49245	48749	34158	61477	07169	90806	19054
04 B 25231	53285	88416	00894	34207	09962	55107	00510	94490
26 D 12870	75061	44081	55657	34207	09962	36417	62180	33141
17 D 26776	14358	22459	35357	34441	09782	34989	08884	52103
12 C 84180	00854	12944	18406	34459	79225	09597	73316	05660
02 A				34567	60730	74769	84260	03391
08 A				34567	83185	93757	32758	87550
24 A				34567	09659	08346	24805	28735
25 B 84284	31450	97241	47116	34577	89082	04543	75938	97686
05 H 10058	24017	93636	26300	34722	08346	28735	36404	04985
25 E 56608	19636	41108	08884	34906	80402	04960	51971	12755
20 I 69334	59050	03458	78968	34933				

15 R 23570	81265	59019	08884	34951	35339	11080	39132	97787
17 D 22459	35357	34441	09782	34989	08884	52103	39614	39270
28 B 42518	66151	45355	32399	35062	01897	10586	40462	02400
10 D 93387	47957	56542	52461	35134	63029	00598	93272	62725
04 G 07317	72856	36254	50495	35184	40023	48499	99003	74415
15 B 81265	59019	08884	34951	35339	11080	39132	97787	91140
09 B 52304	42160	62278	10915	35347	89450	72296	49146	98213
17 D 02514	26776	14358	22459	35357	34441	09782	34989	08884
23 D 50763	38802	13359	87186	35420	86088	54569	81059	47831
22 F 75656	47831	98887	63596	35519	25954	40257	53883	39073
26 H 92841	69492	22751	35924	35543	52956	04503	59434	30453
15 D 17876	56788	32008	20530	35625	01877	90742	49854	49894
05 E 27509	08884	34096	68086	35763	51971	17318	14421	64417
24 D 00013	42813	09082	17410	35872	72943	12725	56912	22897
08 J 26488	22813	44911	25161	35910	62200	78968	40436	59777
26 H 11879	92841	69492	22751	35924	35543	52956	04503	59434
07 F 84663	85047	90762	26212	36011	92403	14384	54683	06696
04 G 50244	96899	07317	72856	36254	50495	35184	40023	48499
16 A 45914	31563	01839	26488	36266	48201	02260	76842	33636

05 H 26300	34722	08346	28735	36404	04985	64758	39284	96522
24 A 09659	08346	24805	28735	36404	04985	39284	52566	11297
04 C 94490	43118	28374	10746	36417	62180	44245	55171	39375
26 E 44081	55657	34207	09962	36417	62180	33141	99371	20610
05 D 99476	53296	65187	01785	36730	27130	81966	40334	41596
06 C 08066	43865	38400	68997	36730	41301	30513	40235	79296
08 D 31508	44590	76924	61728	36730	74908	69899	40415	22223
14 B 41828	89803	65060	70915	36730	31382	03546	40424	43631
17 C 93788	14997	65187	19066	36730	19431	89180	02514	26776
20 B 07551	43865	76924	61728	36730	16028	66495	24853	84149
22 D 10494	51954	17419	10857	36730	18954	03645	31439	84149
23 E 19769	78117	65961	41821	36730	56164	95398	49245	48749
25 D 22322	65604	56101	63601	36730	79543	73187	19968	44143
26 F 24072	28041	41271	83738	37015	02192	58153	02790	53311
12 C 73316	05660	16641	31186	37132	26961	65220	60869	71596
10 A 47124	87057	81440	59500	37134	40452	95726	22773	33306
18 E 44018	88484	11148	10253	37201	66039	83763	89077	67272
18 F 78207	06423	82065	69523	37234	66155	10512	22133	79278
05 F 47831	74294	63677	07102	37759	33428	58806	74165	00369
28 E 83991	08258	89110	57869	37845	12396			
12 B 83786	64990	78893	89717	38014	02400	56912	57155	47135
06 C 76095	54808	08066	43865	38400	68997	36730	41301	30513
21 A			78901	38482	97787	01247	54761	40195
03 C 04198	80160	09597	19716	38488	39968	26233	15224	21026

15 E 01877	90742	49854	49894	38560	43563	52956	28816	08346
23 D 08884	06809	80402	50763	38802	13359	87186	35420	86088
28 A 22805	31046	51021	30738	39026	24642	78968	66188	42518
11 B 17722	64318	33230	00454	39039	68539	09612	57916	79479
19 B 56788	78449	53531	15104	39065	54446	18307	59348	74876
22 G 35519	25954	40257	53883	39073	75669	05236	72911	56788
15 B 08884	34951	35339	11080	39132	97787	91140	04594	39477
25 H 08232	56546	14266	49894	39181	55307	79983	08346	52561
07 G 54683	06696	74423	95398	39231	23096	32993	50602	86357
20 F 56690	31931	20409	72019	39243	82716	08346	49859	70204
17 E 34989	08884	52103	39614	39270	08245	94260	10431	48702
05 H 28735	36404	04985	64758	39284	96522			
24 A 24805	28735	36404	04985	39284	52566	11297	78420	30525
07 I 42084	15901	42462	93639	39286	19584	68115	02849	24021
19 C 54446	18307	59348	74876	39324	00716	08346	62087	24802
17 I 93647	68574	08687	17014	39374	56639	22602	40914	70213
04 C 36417	62180	44245	55171	39375	98051	90702	26242	84663
07 E 22713	33316	85330	02361	39375	98051	90742	26217	84663
11 C 81194	25979	32175	10780	39412	65663	80494	85667	40023
25 I 27561	07965	52485	42160	39425	58450	78896	02533	12276

15 C 39132	97787	91140	04594	39477	99025	85071	47831	22198
26 C 63945	63933	73249	91816	39490	43441	29972	54088	25552
17 E 09782	34989	08884	52103	39614	39270	08245	94260	10431
23 E 54569	81059	47831	30457	39661	89113	96633	02599	82044
07 A 88488	04010	80086	89054	39823	79278	26590	39940	43131
05 B 04932	97336	86649	90441	39903	49020	71683	52245	95650
07 A 89054	39823	79278	26590	39940	43131	83413	41401	89989
18 C 10512	22133	79278	26590	39940	43131	30481	05164	33922
03 C 80160	09597	19716	38488	39968	26233	15224	21026	14932
04 G 72856	36254	50495	35184	40023	48499	99003	74415	11805
11 D 39412	65663	80494	85667	40023	48499	99003	74415	11863
18 I 76528	10566	49364	97937	40023	48499	99003	77415	11860
05 G 59874	21793	72055	51552	40147	10058	24017	93636	26300
12 A 23456	88476	26633	34123	40178	62293	83786	64990	78893
21 A 38482	97787	01247	54761	40195	91932	49674	73800	27054
25 F 97715	95764	47831	45435	40196	26419	80503	74878	26631
06 C 68997	36730	41301	30513	40235	79296	23341	95497	41487
22 G 98887	63596	35519	25954	40257	53883	39073	75669	05236
05 D 01785	36730	27130	81966	40334	41596	62200	13486	20413
06 A 79790	06707	10217	63743	40357	60398	11887	47678	55827
26 E 99371	20610	51275	08772	40373	83995	24072	28041	41271

08 D 61728	36730	74908	69899	40415	22223	57276	57896	20323
14 B 70915	36730	31382	03546	40424	43631	73327	81818	20387
08 K 25161	35910	62200	78968	40436	59777	97021	00194	08563
10 A 87057	81440	59500	37134	40452	95726	22773	33306	22772
28 B 32399	35062	01897	10586	40462	02400	56912	57146	95948
17 J 17014	39374	56639	22602	40914	70213	78968	32423	90932
01 C 32842	75017	62630	71764	40992	33739	75938	69713	19298
25 E 84730	00594	56608	19636	41108	08884	34906	80402	04960
26 F 40373	83995	24072	28041	41271	83738	37015	02192	58153
06 C 43865	38400	68997	36730	41301	30513	40235	79296	23341
07 B 26590	39940	43131	83413	41401	89989	55587	59811	50244
06 D 40235	79296	23341	95497	41487	60109	56671	75931	
17 H 30482	96447	52566	86992	41511	99871	29548	17648	72296
05 D 36730	27130	81966	40334	41596	62200	13486	20413	54299
14 F 13846	79249	58757	16784	41738	31940	17632	78394	94186
18 D 77584	98528	95389	33258	41785	91152	67922	44018	88484
23 B 02495	19769	78117	65961	41821	36730	56164	95398	49245
14 B 59512	55925	78320	76911	41828	89803	65060	70915	36730
04 A 54198	11084	46613	11533	42010	73917	31834	77584	25231

07 I	79769	18059	08737	71120	42084	15901	42462	93639	39286
09 A	85127	09743	50429	52304	42160	62278	10915	35347	89450
21 B	25401	57776	44284	33053	42160	55690	42953	60245	02579
25 I	08847	27561	07965	52485	42160	39425	58450	78896	02533
26 G	20275	44907	10266	85569	42166	93556	45574	11879	92841
24 G	52159	75938	64071	48550	42274				
06 B	51709	95294	75938	26264	42279	05420	42644	76095	54808
02 C	31012	75938	79319	69898	42339				
08 I	08346	52660	69815	94749	42416	52566	19857	13846	32538
07 I	08737	71120	42084	15901	42462	93639	39286	19584	68115
04 D	90709	26240	44842	55135	42507	93162	61012	08101	22712
28 A	39026	24642	78968	66188	42518	66151	45355	32399	35062
06 B	75938	26264	42279	05420	42644	76095	54808	08066	43865
24 D	48188	28769	00719	00013	42813	09082	17410	35872	72943
21 C	44284	33053	42160	55690	42953	60245	02579	72296	05225
22 C	17817	75938	17283	97533	42961	04438	25035	52867	10494
17 B	69126	75938	25178	96522	43051	15871	31467	17429	93788
04 C	09962	55107	00510	94490	43118	28374	10746	36417	62180
07 H	55983	08718	92949	94490	43118	00677	45747	79769	18059
07 B	39823	79278	26590	39940	43131	83413	41401	89989	55587
18 G	22133	79278	26590	39940	43131	30481	05164	33922	22954

20 C 08884	82071	31613	79059	43159	50007	07484	67101	27078
18 B 99398	08718	92949	94457	43192	91850	90213	58594	30248
26 C 63933	73249	91816	39490	43441	29972	54088	25552	16240
15 E 90742	49854	49894	38560	43563	52956	28816	08346	96517
15 C 47831	22198	55249	15117	43616	26038	31023	82412	00853
14 A 36730	31382	03546	40424	43631	73327	81818	20387	68171
17 A 20013	09597	92628	58839	43662	22897	17048	60039	01655
10 B 22773	33306	22772	33306	43769	22367	30912	23938	92842
18 C 53084	29734	16187	26103	43774	54198	11084	03512	93107
29 B 72350	47851	09597	15600	43783	78345	47196	49230	87871
22 G 72911	56788	69119	99501	43804	90106	67638	65837	18061
06 C 42644	76095	54808	08066	43865	38400	68997	36730	41301
20 A 58774	78168	02576	07551	43865	76924	61728	36730	16028
03 B 56769	67046	94811	51690	43998	23359	04198	80160	09597
07 A	00000	21388	75980	44010	88488	04010	80086	89054
18 F 67272	69437	99373	33908	44010	88488	78207	06423	82065
18 E 33258	41785	91152	67922	44018	88484	11148	10253	37201
26 D 91662	51608	12870	75061	44081	55657	34207	09962	36417
20 G 49859	70204	83821	49780	44138	57924	22564	47562	62651
25 D 36730	79543	73187	19968	44143	30747	84730	00594	56608

07 D 33992	00312	24103	53463	44217	99232	61012	08101	22710
04 C 28374	10746	36417	62180	44245	55171	39375	98051	90702
21 B 08346	30359	25401	57776	44284	33053	42160	55690	42953
20 D 18576	49284	58574	72333	44305	02095	97511	99387	10260
18 H 05164	33922	22954	84315	44550	23308	67045	18168	55008
08 D 88902	96446	51788	31508	44590	76924	61728	36730	74908
07 J 30453	91160	86733	66301	44710	88393			
26 H 30453	91160	86733	66301	44726	88317			
04 D 84663	85047	90709	26240	44842	55135	42507	93162	61012
26 G 58153	02790	53311	20275	44907	10266	85569	42166	93556
08 J 80941	85636	26488	22813	44911	25161	35910	62200	78968
08 E 34096	88868	66886	95886	45027	87152	04412	12133	11021
03 A	23456	51747	33040	45035	92588	93926	02329	56912
14 E 12829	92523	02090	82206	45042	26325	04697	05236	92941
16 B 19621	87995	19234	20686	45136	74412	24455	86493	56912
23 B 52159	75938	48550	08438	45193	22732	56854	02495	19769
17 G 56788	07385	83892	75765	45195	72085	49728	24022	50062
14 D 27298	16468	59362	47831	45300	12829	92523	02090	82206
12 D 60869	71596	65982	75938	45328	08438	11367	53532	99303

28 R 78968	66168	42518	66151	45355	32399	35062	01897	10586
25 F 80022	97715	95764	47831	45435	40196	26419	80503	74878
10 R 22367	30912	23938	92842	45442	63306	18447	00203	55463
26 G 10266	85569	42166	93556	45574	11879	92841	69492	22751
14 H 53760	91315	49149	05595	45609	73039	30727	78968	90194
22 B 87203	79225	09597	82140	45666	02756	84284	31450	97241
25 B 83197	33083	09597	82140	45666	02756	84284	31450	97241
09 A				45678	27678	86657	85127	09743
17 A				45678	06788	67332	09839	20013
07 H 92949	94490	43118	00677	45747	79769	18059	08737	71120
14 D 86724	06233	88907	72116	45883	19701	50827	27298	16468
16 A	23456	71390	30934	45914	31563	01839	26488	36266
14 G 98855	08999	14665	99640	46021	10956	60770	17815	72296
22 E 08884	02142	95240	51771	46489	23198	70621	79538	63421
04 A 09987	18562	54198	11084	46613	11533	42010	73917	31834
05 D 62200	13486	20413	54299	46827	27509	08884	34096	68086
08 E 57276	57896	20323	28133	46827	27509	08884	34096	88868
20 C 22683	20323	21245	29739	47022	08884	82071	31613	79059
10 A			00000	47039	47124	87057	81440	59500
25 R 02756	84284	31450	97241	47116	34577	89082	04543	75938

10 A		00000	07039	47124	87057	81440	59500	37134
12 B	38014	02400	57155	47135	70400	87569	84180	00854
05 F	17318	14421	12223	47187	15415	47831	74294	63677
29 F	09597	15600	78345	47196	49230	87871	00154	85903
04 F	56030	84258	09751	47309	53375	30951	59811	50244
08 H	16951	68942	54707	47383	97777	17927	01109	08346
11 C	20190	55088	28079	47545	19419	63281	63442	81194
20 G	49780	44138	22564	47562	62651	91786	72296	10144
06 A	63743	40357	11887	47678	55827	51709	95294	75938
02 B	79786	97224	90818	47758	84147	31012	75938	79319
28 D	18805	92398	90818	47758	85865	33971	75938	83991
05 F	64417	12223	15415	47831	74294	63677	07102	37759
08 F	04412	12133	15415	47831	74200	63686	61738	80503
14 D	50827	27298	59362	47831	45300	12829	92523	02090
15 C	04594	39477	85071	47831	22198	55249	15117	43616
17 E	48702	12214	52147	47831	67610	63497	14594	75579
20 D	07101	27078	92134	47831	18576	49284	58574	72333
22 F	79538	63421	75656	47831	98887	63596	35519	25954
23 E	35420	86088	81059	47831	30457	39661	89113	96633
25 F	26246	80022	95764	47831	45435	40196	26419	80503
05 A		67890	85486	47842	72346	65464	70505	29830
29 A	78601	86447	72350	47851	09597	15600	43783	78345
04 E	71296	65938	33338	47937	75972	22900	56030	84258
10 C	89546	03256	93387	47957	56542	52461	35134	63029

26 D 77802	16435	23308	67045	47993	11631	91662	51608	12870
24 C 03217	78968	59159	78968	48188	28769	00719	00013	42813
16 A 31563	01839	26488	36266	48201	02260	76842	33636	78968
04 G 36254	50495	35184	40023	48499	99003	74415	11805	
11 D 65663	80494	85667	40023	48499	99003	74415	11863	
18 I 10566	49364	97937	40023	48499	99003	77415	11860	
25 G 05317	02642	56788	28462	48531	93195	08232	56546	14266
05 C 75938	06160	08357	23453	48538	81390	02576	99476	53296
23 A 82621	90981	52159	75938	48550	08438	45193	22732	56854
24 G 90981	52159	75938	64071	48550	42274			
17 E 39270	08245	94260	10431	48702	12214	83552	52147	47831
23 C 36730	56164	95398	49245	48749	34158	61477	07169	90806
02 R 17243	64171	07778	09597	48828	00755	53504	79786	97224
18 B 90213	58594	30248	28807	49010	23147	97949	25972	53084
22 D 03645	31439	84149	09689	49017	20404	09860	31893	89332
05 R 97336	86649	90441	39903	49020	71683	52245	95650	75938
15 A	12345	93205	29567	49097	61498	79034	57357	57180
24 E 96934	67027	70558	16312	49097	12685	09597	19627	27004
09 R 10915	35347	89450	72296	49146	98213	25433	01091	92472
14 H 95232	07828	53760	91315	49149	05595	45609	73039	30727
29 R 15600	43783	78345	47196	49230	87871	00154	85903	90641

23 C 41421	36730	56164	95398	49245	48749	34158	61477	07169
20 D 20218	92134	47831	18576	49284	58574	72333	44305	02095
18 H 18168	55008	76528	10566	49364	97937	40023	48499	99003
25 J 78896	02533	12276	72296	49371				
08 I 52566	19857	13846	32538	49485	89015	72296	28563	89954
13 B 22899	08618	97104	09620	49527	95207	50656	08547	09597
21 A 01247	54761	40195	91932	49674	73800	27054	16174	02063
14 F 31940	17632	78394	94186	49689	08346	52660	18029	98855
17 G 83892	75765	45195	72085	49728	24022	50062	27248	95594
20 G 08346	49859	70204	83821	49780	44138	57924	22564	47562
15 E 20530	35625	01877	90742	49854	49894	38560	43563	52956
20 F 72019	39243	82716	08346	49859	70204	83821	49780	44138
15 E 35625	01877	90742	49854	49894	38560	43563	52956	28816
25 H 93195	08232	56546	14266	49894	39181	55307	79983	08346
20 C 82071	31613	79059	43139	50007	07484	07101	27078	20218
17 G 45195	72085	49728	24022	50062	27248	95594	08346	04073
25 A 83185	93757	33758	87550	50241	67713	14676	96743	83197
04 G 47309	53375	30951	59811	50244	96899	07317	72856	36254
07 B 41401	89989	55587	59811	50244	85833	54220	08686	18073
09 A 27678	86657	85127	09743	50429	52304	42160	62278	10915

04 G 96899	07317	72856	36254	50495	35184	40023	48499	99003
01 A 11228	73928	65464	05744	50524	78007	09597	84359	22385
07 G 95398	39231	23096	32993	50602	86357	98842	55747	00243
13 H 97104	09620	49527	95207	50656	08547	09597	81528	74554
23 D 58938	08884	06809	80402	50763	38802	13359	87186	35420
14 D 88907	72116	45883	19701	50827	27298	16468	59362	47831
04 F 75972	22900	56030	84258	50890	09751	47309	53375	30951
28 A	56789	22805	31046	51021	30738	39026	24642	78968
26 E 62180	33141	99371	20610	51275	08772	40373	83995	24072
05 G 56788	59874	21793	72055	51552	40147	10058	24017	93636
26 D 67045	47993	11631	91662	51608	12870	75061	44081	55657
03 B 73077	56769	67046	94811	51690	43998	23359	04198	80160
06 B 60398	11887	47678	55827	51709	95294	75938	26264	42279
03 A			23456	51747	33040	45035	92588	93926
22 E 89332	08884	02142	95240	51771	46489	23198	70621	79538
29 C 00154	85903	90641	92132	51777				
08 C 08438	05789	88902	96446	51788	31508	44590	76924	61728
22 D 04438	25035	52867	10494	51954	17419	10857	36730	18954
05 F 08884	34096	68086	35763	51971	17318	14421	64417	12223
25 E 08884	34906	80402	04960	51971	12755	59869	26246	80022

22 H 90106	67638	65837	18061	52002	28044	73169		
17 P 34441	09782	34989	08884	52103	39614	39270	08245	94260
17 E 10431	48702	12214	83552	52147	47831	67610	63497	14594
23 A 66802	86317	82621	90981	52159	75938	48550	08438	45193
24 F 11887	66802	82621	90981	52159	75938	64071	48550	42274
05 R 90441	39903	49020	71683	52245	95650	75938	06160	08357
09 A 86657	85127	09743	50429	52304	42160	62278	10915	35347
10 C 62701	93387	47957	56542	52461	35134	63029	00598	93272
25 I 52561	08847	27561	07965	52485	42160	39425	58450	78896
29 A			12345	52487	63198	61691	78601	86447
25 H 39181	55307	79983	08346	52561	08847	27561	07965	52485
08 I 52660	69815	94749	42416	52566	19857	13846	32538	49485
17 H 04073	68877	30482	96447	52566	86992	41511	99871	29548
24 A 28735	36404	04985	39284	52566	11297	78420	30525	62677
02 A 74769	84260	03391	18187	52608	65464	17243	64171	07778
22 A 74769	08760	03391	18187	52608	65464	71543	87203	79225
19 B 07408	08577	57290	10435	52639	56788	78449	53531	15104
08 H 97777	17927	01109	08346	52660	69815	94749	42416	52566
14 F 78394	94186	49689	08346	52660	18029	98855	08999	14665
22 C 97533	42961	04438	25035	52867	10494	51954	17419	10857
15 E 49854	49894	38560	43563	52956	28816	08346	96517	
26 H 69492	22751	35924	35543	52956	04503	59434	30453	91160

24 E	56912	22897	70210	08694	52962	96934	67027	70558	16312
18 C	49010	23147	97949	25072	53084	29734	16187	26103	43776
04 B	73917	31834	77584	25231	53285	88416	00894	34207	09962
07 C	18073	31834	77584	25231	53285	58327	02484	24687	66120
05 C	48538	81390	02576	99476	53296	65187	01785	36730	27130
26 F	37015	02192	58153	02790	53311	20275	44907	10266	85569
04 F	84258	50890	09751	47309	53375	30951	59811	50244	96899
28 D	97750	09597	70108	18247	53423	18805	92398	06089	90818
07 D	66120	33992	00312	24103	53463	44217	99232	61012	08101
02 B	07778	09597	48828	00755	53504	79786	97224	06828	90818
13 B	08547	09597	81528	74554	53504	92227	65071	32860	99163
19 B	10435	52639	56788	78449	53531	15104	39065	54446	18307
12 D	75938	45328	08438	11367	53532	99303	10830	02314	75658
28 C	56912	57146	95948	73602	53544	13945	73843	65202	18406
14 H	72296	05306	95232	07828	53760	91315	49149	05595	45609
08 G	63686	61738	80503	26026	53883	55341	03734	57191	08894
22 G	63596	35519	25954	40257	53883	39073	75669	05236	72911
26 C	91816	39490	43441	29972	54088	25552	16240	77802	16435
08 H	81671	00454	16951	68942	54137	54707	47383	97777	17927
04 A	21388	75980	09987	18562	54198	11084	46613	11533	42010
18 C	29734	16187	26103	43776	54198	11084	03512	93107	98350

07 C 55587	59811	50240	85833	54220	08686	18073	31834	77584
05 D 41596	62200	13086	20413	54299	06827	27509	08884	34096
19 H 78440	53531	15104	39065	54446	18307	59348	74876	39324
26 H 60115	20361	17114	18904	54478	63945	63933	73249	91816
23 D 13359	81186	35420	86088	54569	81059	47831	30457	39661
07 F 26212	36011	92403	14384	54683	06696	74423	95398	39231
08 H 00454	16951	68942	54137	54707	47383	97777	17927	01109
21 A 76901	38482	97787	01247	54761	40195	91932	49674	73800
06 H 42279	05420	42644	76095	54808	08066	43865	38400	68997
18 H 44550	23308	67045	18168	55008	76528	10566	49364	97937
11 B 57916	79479	95167	20190	55088	76089	28079	47545	19419
04 H 88416	00894	34207	09962	55107	00510	94490	43118	28374
04 D 85047	90709	26240	44842	55135	42507	93162	61012	08101
04 C 10746	36417	62180	44245	55171	39375	98051	90702	26242
15 C 99025	85071	47831	22198	55249	15117	43616	26038	31023
26 A 06957	12540	22288	60115	55305	00685	16057	74530	22248
25 H 56546	14266	49894	39181	55307	79983	08346	52561	08847
08 G 61738	80503	26026	53883	55341	03734	57191	08894	56788
13 A	56789	77418	56912	55401	23130	05042	22899	08618

10 C 45442	63306	18447	00203	55463	89546	03256	62701	93387
07 H 43131	83413	41401	84989	55587	59811	50244	85833	54220
26 D 51608	12870	75061	44081	55657	34207	09962	36417	62180
21 H 57776	44284	33053	42160	55690	42953	60245	02579	72296
07 G 32993	50602	86357	98842	55747	00243	55983	08718	92949
06 A 40357	60398	11887	47678	55827	51709	95294	75938	26264
14 A 03447	14724	18774	59512	55925	78320	76911	41828	89803
07 H 86357	98842	55747	00243	55983	08718	92949	94490	43118
04 F 33338	47937	75972	22900	56030	84258	50890	09751	47309
25 D 78320	64675	22322	65604	56101	63601	36730	79543	73187
23 B 78117	65961	41821	36730	56164	95398	49245	48749	34158
08 B 23363	60274	81885	09597	56195	88927	00084	83234	18783
25 C 89082	04543	75938	97686	56422	92853	88908	78320	64675
21 D 92472	73877	77612	60934	56456	68146			
10 C 03256	62701	93387	47957	56542	52461	35134	63029	00598
25 H 28462	48531	93195	08232	56546	14266	49894	39181	55307
25 F 44143	30747	84730	00594	56608	19636	41108	08884	34906
17 I 68574	08687	17014	39374	56639	22602	40914	70213	78968
24 C 88821	89609	02095	21802	56639	03217	78968	59159	78968
06 D 23341	95497	41487	60109	56671	75931			

20 F 63375	08430	19149	02646	56690	31931	20409	72019	39243
03 B 02329	56912	57146	73077	56769	67046	94811	51690	43998
05 G 74165	00369	77177	75296	56788	59874	21793	72055	51552
08 G 55341	03734	57191	08894	56788	81671	00454	16951	68942
14 E 26325	04697	05236	92941	56788	13846	79249	58757	16784
15 D 82412	00853	89695	17876	56788	32008	20530	35625	01877
17 G 97446	04794	72325	25204	56788	07385	83892	75765	45195
19 B 08577	57290	10435	52639	56788	78449	53531	15104	39065
20 E 97571	99387	10260	25204	56788	63375	98430	19149	02646
22 G 39073	75669	05236	72911	56788	69119	99501	43804	90106
25 G 88157	90221	05317	02642	56788	28462	48531	93195	08232
13 A				56789	77418	56912	55401	23130
19 A				56789	06441	89418	91468	84355
28 A				56789	22805	31046	51021	30738
23 B 48550	08438	45193	22732	56854	02495	19769	78117	65961
03 A 45035	92588	93926	02329	56912	57146	73077	56769	67046
12 B 78893	89717	38014	02400	56912	57155	47135	70400	87569
13 A		56789	77418	56912	55401	23130	05042	22899
16 C 45136	74412	24455	86493	56912	74309	91669	69083	79291
24 D 17410	35872	72943	12725	56912	22897	70210	08694	52962
28 B 01897	10586	40462	02400	56912	57146	95948	73602	53544
03 A 92588	93926	02329	56912	57146	73077	56769	67046	94811
28 B 10586	40462	02400	56912	57146	95948	73602	53544	13945
12 B 89717	38014	02400	56912	57155	47135	70400	87569	84180
15 A 49097	61498	79034	57357	57180	20323	23570	81265	59019
08 G 26026	53883	55341	03734	57191	08894	56788	81671	00454
08 D 74908	69899	40415	22223	57276	57896	20323	28133	46827

19 A 75498	82206	07408	08577	57290	10435	52639	56788	78449
15 A 29567	49097	61498	79034	57357	57180	20323	23570	81265
17 I 99871	29548	17648	72296	57638	93647	68574	08687	17014
21 R 02063	08346	30359	25401	57776	44284	33053	42160	55690
28 E 75938	83991	08258	89110	57869	37845	12396		
08 D 69899	40415	22223	57276	57896	20323	28133	46827	27509
11 R 00454	39039	68539	09612	57916	79479	95167	20190	55088
20 G 70204	83821	49780	44138	57924	22564	47562	62651	91786
26 F 41271	83738	37015	02192	58153	02790	53311	20275	44907
07 C 31834	77584	25231	53285	58327	02484	24687	66120	33992
25 I 07965	52485	42160	39425	58450	78896	02533	12276	72296
20 D 92134	47831	18576	49284	58574	72333	44305	02095	97571
18 B 94457	43192	91850	90213	58594	30248	28807	49010	23147
14 F 92941	56788	13846	79249	58757	16784	41738	31940	17632
20 A 13667	74422	09942	61114	58774	78168	02576	07551	43865
05 F 63677	07102	37759	33428	58806	74165	00369	77177	75296
17 A 09839	20013	09597	92628	58839	43662	22897	17048	60039
23 C 61477	07169	90806	19054	58938	08884	06809	80402	50763
15 B 57180	20323	23570	81265	59019	08884	34951	35339	11080

20 H 23020	67596	72691	69334	59050	03458	78968	34933
24 C 21802	56639	03217	78968	59159	78968	48188	28769 00719
19 B 15104	39065	54446	18307	59348	74876	39324	00716 08346
14 D 19701	50827	27298	16468	59362	47831	45300	12829 92523
22 B 84284	31450	97241	90818	59426	32338	17817	75938 17283
26 H 35924	35543	52956	04503	59434	30453	91160	86733 66301
10 A 47039	47124	87057	81440	59500	37134	40452	95726 22773
14 A 75938	03447	14724	18774	59512	55925	78320	76911 41828
08 K 35910	62200	78968	40436	59777	97021	00194	08563 02651
04 F 09751	47309	53375	30951	59811	50244	96899	07317 72856
07 R 83413	41401	89989	55587	59811	50244	85833	54220 08686
25 F 80402	04960	51971	12755	59869	26246	80022	97715 95764
05 G 00369	77177	75296	56788	59874	21793	72055	51552 40147
17 R 58839	43662	22897	17048	60039	01655	84734	74917 69126
06 D 79296	23341	95497	41487	60109	56671	75931	
26 A 75980	06957	12540	22288	60115	55305	00685	16057 74530
26 R 00685	16057	74530	22248	60115	20361	17114	18904 54478
21 C 33053	42160	55690	42953	60245	02579	72296	05225 92627
08 A 31934	14969	29692	23363	60274	81885	09597	56195 88927
06 A 06707	10217	63743	40357	60398	11887	47678	55827 51709

01 A				78901	60730	74769	85760	97799	11228
02 A				34567	60730	74769	84260	03391	18187
22 A				67890	60730	74769	08760	03391	18187
14 G	14665	99640	46021	10956	60770	17815	72296	05306	95232
14 I	90194	07645	66919	21177	60802	32317	20881		
12 D	31186	37132	26961	65220	60869	71596	65982	75938	45328
20 H	91786	72296	10144	63305	60912	01910	26488	23020	67596
21 D	01091	92472	73877	77612	60934	56456	68146		
04 E	44842	55135	42507	93162	61012	08101	22712	33316	71296
07 D	24103	53463	44217	99232	61012	08101	22710	33314	71296
20 A	89012	13667	74422	09942	61114	58774	78168	02576	07551
23 C	95398	49245	48749	34158	61477	07169	90806	19054	58938
15 A	12345	93205	29567	49097	61498	79034	57357	57180	20323
29 A		12345	52487	63198	61691	78601	86447	18244	72350
08 D	51788	31508	44590	76924	61728	36730	74908	69899	40415
20 H	02576	07551	43865	76924	61728	36730	16028	66495	24853
08 F	15415	47831	74200	63686	61738	80503	26026	53883	55341
19 C	74876	39324	00716	08346	62087	24802	13109	01136	73214
04 C	43118	28374	10746	36417	62180	44245	55171	39375	98051
26 E	55657	34207	09962	36417	62180	33141	99371	20610	51275
05 D	27130	81966	40334	41596	62200	13486	20413	54299	46827
08 J	22813	44911	25161	35910	62200	78968	40436	59777	97021

09 A 09743	50429	52304	42160	62278	10915	35347	89450	12296
12 A 88476	26633	34123	40178	62293	83786	64990	78893	89717
01 B 12393	78565	32842	75017	62630	71764	40992	33739	75938
20 G 44138	57924	22564	47562	62651	91786	72296	10144	63305
24 H 52566	11297	78420	30525	62677	85249	72296	74621	06765
10 C 00203	55463	89546	03256	62701	93387	47957	56542	52461
10 D 35134	63029	00598	93272	62725	11364			
10 D 47957	56542	52461	35134	63029	00598	93272	62725	11364
29 A		12345	52487	63198	61691	78601	86447	16244
11 C 76089	28079	47545	19419	63281	63442	81194	25979	32175
20 G 62651	91786	72296	10144	63305	60912	01910	26488	23020
10 H 30912	23938	92842	45442	63306	18447	00203	55463	89546
20 E 99387	10260	25204	56788	63375	98430	19149	02646	56690
22 F 46489	23198	70621	79538	63421	27801	75656	47831	98887
11 C 28079	47545	19419	63281	63442	81194	25979	32175	10780
17 F 83552	52147	47831	67610	63497	14594	75579	89892	12916
07 J 19584	68115	02849	24021	63529	19266	83498	30453	91160
22 F 27801	75656	47831	98887	63596	35519	25954	40257	53883
25 D 64675	22322	65604	56101	63601	36730	79543	73187	19968

05 F 47187	15415	47831	74294	63677	01102	37759	33428	58806
08 F 11021	15415	47831	74200	63686	61738	80503	26026	53883
06 A 12345	79790	06707	10217	63743	40357	60398	11887	47678
26 B 17114	18904	54478	63945	63933	73249	91816	39490	43441
26 B 20361	17114	18904	54478	63945	63933	73249	91816	39490
24 F 82621	90981	52159	75938	64071	48550	42274		
02 A 18187	52608	65464	17243	64171	07778	09597	48828	00755
11 A 18562	91842	97538	17722	64318	33230	00454	39039	68539
05 E 35763	51971	17318	14421	64417	12223	47187	15415	47831
25 C 56422	92853	88908	78320	64675	22322	65604	56101	63601
05 H 08346	28735	36404	04985	64758	39284	96522		
18 A 21388	75980	74006	15426	64834	89020	31384	99398	08718
16 D 75700	22645	05583	90584	64880				
12 A 34123	40178	62293	83786	64990	78893	89717	38014	02400
14 B 78320	76911	41828	89803	65060	70915	36730	31382	03546
13 B 81528	74554	53504	92227	65071	32860	99163	90656	15734
05 C 81390	02576	99476	53296	65187	01785	36730	27130	81966
17 C 31467	17429	93788	14997	65187	19066	36730	19431	89180
28 C 73602	53544	13945	73843	65202	18406	72170	97750	09597

12 D	16641	31186	37132	26961	65220	60869	71596	65982	75438
01 A	85760	97799	11228	73928	65460	05744	50524	78007	09597
02 A	84260	03391	18187	52608	65464	17243	64171	07778	09597
05 A	67890	85486	47842	72346	65460	70505	29830	87014	09597
22 A	08760	03391	18187	52608	65464	71543	87203	79225	09597
25 D	88908	78320	64675	22322	65604	56101	63601	36730	79543
11 D	25979	32175	10780	39412	65663	80494	85667	40023	48499
22 H	99501	43804	90106	67638	65837	18061	52002	28044	73169
04 E	08101	22712	33316	71296	65938	22762	33338	47937	75972
07 E	08101	22710	33314	71296	65938	22713	33316	85330	02361
23 R	56854	02495	19769	78117	65961	41821	36730	56164	95398
12 D	26961	65220	60869	71596	65982	75938	45328	08438	11367
18 F	88484	11148	10253	37201	66039	83763	89077	67272	69437
07 D	53285	58327	02484	24687	66120	33992	00312	24103	53463
28 B	24642	78968	66188	42518	66151	45355	32399	35062	01897
18 G	06423	82065	69523	37234	66155	10512	22133	79278	26590
28 A	30738	39026	24642	78968	66188	42518	66151	45355	32399
07 J	83498	30453	91160	86733	66301	44710	88393		
26 H	59434	30453	91160	86733	66301	44726	88317		
20 R	76924	61728	36730	16028	66495	24853	84149	09689	22683
23 A			12345	86714	66802	86317	82621	90981	52159
24 F	22057	07152	11901	11887	66802	82621	90981	52159	75938

08 F 27509	08884	34096	88868	66886	95886	45027	87152	04412
14 I 30727	78968	90194	07645	66919	21111	60802	32317	20881
24 E 70210	08694	52962	96934	67027	70558	16312	49097	12685
18 H 22954	84315	44550	23308	67045	18168	55008	76528	10566
26 D 16240	77802	16435	23308	67045	47993	11631	91662	51608
03 B 56912	57146	73077	56769	67046	94811	51690	43998	23359
18 E 37201	66039	83763	89077	67272	69437	99373	33908	44010
09 B 98213	25433	01091	92472	67275	70753	76254	77776	68076
17 A		45678	06788	67332	09839	20013	09597	92628
20 H 60912	01910	26488	23020	67596	72691	69334	59050	03458
17 F 12214	83552	52147	47831	67610	63497	14594	75579	89892
22 H 69119	99501	43804	90106	67638	65837	18061	52002	28044
25 A 93757	33758	87550	50241	67713	14676	96743	83197	33083
05 A				67890	85486	47842	72346	65464
14 A				67890	82825	75938	03447	14724
22 A				67890	60730	74769	08760	03391
18 E 95389	33258	41785	91152	67922	44018	88484	11148	10253
09 C 67275	70753	76254	77776	68076				
05 F 46827	27509	08884	34096	68086	35763	51971	17318	14421
07 I 42462	93639	39286	19584	68115	02849	24021	63529	19266

21 D 73877	77612	60934	56456	68146		
14 C 43631	73327	81818	20387	68171	69152	31762 08884 86724
11 B 64318	33230	00454	39039	68539	09612	57916 79479 95167
17 I 17648	72296	57638	93647	68574	08687	17014 39374 56639
17 H 27248	95594	08346	04073	68877	30462	96447 52566 86992
08 H 56788	81671	00454	16951	68942	54137	54707 47383 97777
06 C 54808	08066	43865	38400	68997	36730	41301 30513 40235
16 C 86493	56912	74309	91669	69083	79291	73568 28854 75700
22 G 75669	05236	72911	56788	69119	99501	43804 90106 67638
17 B 60039	01655	84734	74917	69126	75938	25178 96522 43051
14 C 73327	81818	20387	68171	69152	31762	08884 86724 06233
20 H 26488	23020	67596	72691	69334	59050	03458 78968 34933
18 F 66039	83763	89077	67272	69437	99373	33908 44010 88488
26 G 93556	45574	11879	92841	69492	22751	35924 35543 52956
18 F 88488	78207	06423	82065	69523	37234	66155 10512 22133
01 C 71764	40992	33739	75938	69713	19298	08276 89338
08 H 17927	01109	08346	52660	69815	94749	42416 52566 19857
02 C 84147	31012	75938	79319	69898	42339	
08 D 76924	61728	36730	74908	69899	40415	22223 57276 57896

28 D 18406	72170	97750	09597	70108	18247	53423	18805	92398
20 F 39243	82716	08346	49859	70204	83821	49780	44138	57924
24 D 72943	12725	56912	22897	70210	08694	52962	96934	67027
17 J 39374	56639	22602	40914	70213	78968	32423	90932	75623
12 R 02400	56912	57155	47135	70400	87569	84180	00854	12944
05 A 85486	47842	72346	65464	70505	29830	87014	09597	71500
24 E 08694	52962	96934	67027	70558	16312	49097	12685	09597
22 F 95240	51771	46489	23198	70621	79538	63421	27801	75656
09 B 25433	01091	92472	67275	70753	76254	77776	68076	
14 B 76911	41828	89803	65060	70915	36730	31382	03546	40424
07 I 45747	79769	18059	08737	71120	42084	15901	42462	93639
04 E 61012	08101	22712	33316	71296	65938	22762	33338	47937
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16 A			23456	71390	30934	45914	31563	01839
05 A 70505	29830	87014	09597	71500	04932	97336	86649	90441
22 A 03391	18187	52608	65464	71543	87203	79225	09597	82140
12 D 37132	26961	65220	60869	71596	65982	75938	45328	08438
05 B 86649	90441	39903	49020	71683	52245	95650	75938	06160
01 R 78565	32842	75017	62630	71764	40992	33739	75938	69713

20 F 02646	56690	31931	20409	72019	39243	82716	08346	49859
05 G 75296	56788	59874	21793	72055	51552	40147	10058	24017
17 G 07385	83892	75765	45195	72085	49728	24022	50062	27248
14 C 08884	86724	06233	88907	72116	45883	19701	50827	27298
28 C 13945	73843	65202	18406	72170	97750	09597	70108	18247
08 I 13846	32538	49485	89015	72296	28563	89954	80941	85636
09 B 62278	10915	35347	89450	72296	49146	98213	25433	01091
14 G 46021	10956	60770	17815	72296	05306	95232	07828	53760
17 I 41511	99871	29548	17648	72296	57638	93647	68574	08687
20 G 22564	47562	62651	91786	72296	10144	63305	60912	01910
21 C 55690	42953	60245	02579	72296	05225	92627	10409	01091
24 B 78420	30525	62677	85249	72296	74621	06765	88821	89609
25 I 58450	78896	02533	12276	72296	49371			
17 F 89892	12916	97446	04794	72325	25204	56788	07385	83892
20 D 47831	18576	49284	58574	72333	44305	02095	97571	99387
05 A	67890	85486	47842	72346	65464	70505	29830	87014
29 A 61691	78601	86447	18244	72350	47851	09597	15600	43783
20 H 01910	26488	23020	67596	72691	69334	59050	03458	78968
04 G 59811	50244	96899	07317	72856	36254	50495	35184	40023
22 G 53883	39073	75669	05236	72911	56788	69119	99501	43804
24 D 42813	09082	17410	35872	72943	12725	56912	22897	70210
14 H 91315	49149	05595	45609	73039	30727	78968	90194	07645

03 A 93926	02329	56912	57146	73077	56769	67046	94811	51690
22 H 65837	18061	52002	28044	73169				
25 D 56101	63601	36730	79543	73187	19968	44143	30747	84730
19 C 62087	24802	13109	01136	73214				
26 F 18904	54478	63945	63933	73249	91816	39490	43441	29972
12 C 18406	34459	79225	09597	73316	05660	16641	31186	37132
14 B 31382	03546	40424	43631	73327	81818	20387	68171	69152
16 C 74309	91669	69083	79291	73568	28854	75700	22645	05583
28 C 02400	56912	57146	95948	73602	53544	13945	73843	65202
21 A 54761	40195	91932	49674	73800	27054	16174	02063	08346
28 C 95948	73602	53544	13945	73843	65202	18406	72170	97750
21 C 92627	10409	01091	92472	73877	77612	60934	56456	68146
04 B 11084	46613	11533	42010	73917	31834	77584	25231	53285
01 A 74769	85760	97799	11228	73928	65464	05744	50524	78007
18 A	00000	21388	75980	74006	15426	64834	89020	31384
05 F 07102	37759	33428	58806	74165	00369	77177	75296	56788
08 F 12133	11021	15415	47831	74200	63686	61738	80503	26026
05 F 12223	47187	15415	47831	74294	63677	07102	37759	33428
16 C 74412	24455	86493	56912	74309	91669	69083	79291	73568

16 C	87995	19234	20686	45136	74412	24455	86493	56912	74309
04 H	35184	40023	48499	99003	74415	11805			
11 D	85667	40023	48499	99003	74415	11863			
20 A			89012	13667	74422	09942	61114	58774	78168
07 G	92403	14384	54683	06696	74423	95398	39231	23096	32993
16 B	02260	76842	33636	78968	74472	23223	19621	87995	19234
26 B	60115	55305	00685	16057	74530	22248	60115	20361	17114
13 B	50656	08547	09597	81528	74554	53504	92227	65071	32860
24 B	30525	62677	85249	72296	74621	06765	88821	89609	02095
01 A			78901	60730	74769	85760	97799	11228	73928
02 A			34567	60730	74769	84260	03391	18187	52608
22 A			67890	60730	74769	08760	03391	18187	52608
19 C	39065	54446	18307	59348	74876	39324	00716	08346	62087
25 G	45435	40196	26419	80503	74878	26631	88157	90221	05317
08 D	44590	76924	61728	36730	74908	69899	40415	22223	57276
17 B	17048	60039	01655	84734	74917	69126	75938	25178	96522
01 B	22385	12393	78565	32842	75017	62630	71764	40992	33739
26 D	11631	91662	51608	12870	75061	44081	55657	34207	09962
05 G	58806	74165	00369	77177	75296	56788	59874	21793	72055
19 A	06441	89418	91468	84355	75498	82206	07408	08577	57290
17 F	47831	67610	63497	14594	75579	89892	12916	97446	04794

17 J 70213	78968	32423	90932	75623				
22 F 70621	79538	63421	27801	75656	47631	98887	63596	35519
12 E 53532	99303	10830	02314	75658				
22 G 25954	40257	53883	39073	75669	05236	72911	56788	69119
16 D 69083	79291	73568	28854	75700	22645	05583	90584	64880
17 G 25204	56788	07385	83892	75765	45195	72085	49728	24022
06 D 95497	41487	60109	56671	75931				
01 C 62630	71764	40992	33739	75938	69713	19298	08276	89338
02 C 90818	47758	84147	31012	75938	79319	69898	42339	
05 B 49020	71683	52245	95650	75938	06160	08357	23453	48538
06 B 47678	55827	51709	95294	75938	26264	42279	05420	42644
08 C 78992	00915	01348	09118	75938	24194	08438	05789	88902
12 D 65220	60869	71596	65982	75938	45328	08438	11367	53532
14 A		67890	82825	75938	03447	14724	18774	59512
17 B 01655	84734	74917	69126	75938	25178	96522	43051	15871
22 C 90818	59426	32338	17817	75938	17283	97533	42961	04438
23 A 86317	82621	90981	52159	75938	48550	08438	45193	22732
24 F 66802	82621	90981	52159	75938	64071	48550	42274	
25 C 47116	34577	89082	04543	75938	97686	56422	92853	88908
28 E 90818	47758	85865	33971	75938	83991	08258	89110	57869
04 F 65938	22762	33338	47937	75972	22900	56030	84258	50890
04 A		00000	21388	75980	09987	18562	54198	11084
07 A		00000	21388	75980	44010	88488	04010	80086
11 A		00000	21388	75980	09987	18562	91842	97538
18 A		00000	21388	75980	74006	15426	64834	89020
26 A		00000	21388	75980	06957	12540	22288	60115
11 B 79479	95167	20190	55088	76089	28079	47545	19419	63281

06 B 26264	42279	05420	42644	76095	54808	08066	43865	38400
09 C 01091	92472	67275	70753	76254	77776	68076		
18 H 23308	67045	18168	55008	76528	10566	49364	97937	40023
08 K 08563	02651	88039	15573	76585	16901			
16 H 26488	36266	48201	02260	76842	33636	78968	74472	23223
14 A 18774	59512	55925	78320	76911	41828	89803	65060	70915
08 D 96446	51788	31508	44590	76924	61728	36730	74908	69899
20 B 78168	02576	07551	43865	76924	61728	36730	16028	66495
05 G 33428	58806	74165	00369	77177	75296	56788	59874	21793
18 I 97937	40023	48499	99003	77415	11860			
13 A			56789	77418	56912	55401	23130	05042
04 B 11533	42010	73917	31834	77584	25231	53285	88416	00894
07 C 54220	08686	18073	31834	77584	25231	53285	58327	02484
18 D 93107	98350	30353	31834	77584	98528	95389	33258	41785
21 D 10409	01091	92472	73877	77612	60934	56456	68146	
09 C 92472	67275	70753	76254	77776	68076			
26 C 29972	54088	25552	16240	77802	16435	23308	67045	47993
01 B 73928	65464	05744	50524	78007	09597	84359	22385	12393
23 B 22732	56854	02495	19769	78117	65961	41821	36730	56164
20 A 74422	09942	61114	58774	78168	02576	07551	43865	76924
18 F 99373	33908	44010	88488	78207	06423	82065	69523	37234

14 A 14724	18774	59512	55925	78320	76911	41828	89803	65060
25 C 97686	56422	92853	88908	78320	64675	22322	65604	56101
29 B 47851	09597	15600	43783	78345	47196	49230	87871	00154
14 F 16784	41738	31940	17632	78394	94186	49689	08346	52660
24 B 04985	39284	52566	11297	78420	30525	62677	85249	72296
19 B 57290	10435	52639	56788	78449	53531	15104	39065	54446
01 B 09597	84359	22385	12393	78565	32842	75017	62630	71764
29 A 12345	52487	63198	61691	78601	86447	18244	72350	47851
12 A 40178	62293	83786	64990	78893	89717	38014	02400	56912
25 I 52485	42160	39425	58450	78896	02533	12276	72296	49371
01 A				78901	60730	74769	85760	97799
21 A				78901	38482	97787	01247	54761
08 J 44911	25161	35910	62200	78968	40436	59777	97021	00194
14 I 05595	45609	73039	30727	78968	90194	07645	66919	21177
16 B 48201	02260	76842	33636	78968	74472	23223	19621	87995
17 J 56639	22602	40914	70213	78968	32423	90932	75623	
20 H 72691	69334	59050	03458	78968	34933			
24 C 02095	21802	56639	03217	78968	59159	78968	48188	28769
24 C 56639	03217	78968	59159	78968	48188	28769	00719	00013
28 A 51021	30738	39026	24642	78968	66188	42518	66151	45355
08 B 00084	83234	18783	08863	78992	00915	01348	09118	75938
15 A 93205	29567	49097	61498	79034	57357	57180	20323	23570
20 C 47022	08884	82071	31613	79059	43139	50007	07484	07101

12 C 00854	12944	18406	34459	79225	09597	73316	05660	16641
22 R 52608	65464	71543	87203	79225	09597	82140	45666	02756
14 F 05236	92941	56788	13846	79249	58757	16784	41738	31940
07 A 04010	80086	89054	39823	79278	26590	39940	43131	83413
18 G 37234	66155	10512	22133	79278	26590	39940	43131	30481
16 C 56912	74309	91669	69083	79291	73568	28854	75700	22645
06 C 36730	41301	30513	40235	79296	23341	95497	41487	60109
02 C 47758	84147	31012	75938	79319	69898	42339		
11 B 39039	68534	09612	57916	79479	95167	20190	55088	76089
22 F 51771	46489	23198	70621	79538	63421	27801	75656	47831
25 D 65604	56101	63601	36730	79543	73187	19968	44143	30747
07 H 94490	43118	00677	45747	79769	18059	08737	71120	42084
02 B 09597	48828	00755	53504	79786	97224	06828	90818	47758
06 A			12345	79790	06707	10217	63743	40357
25 H 14266	49894	39181	55307	79983	08346	52561	08847	27561
25 F 51971	12755	59869	26246	80022	97715	95764	47831	45435
07 A 75980	44010	88488	04010	80086	89054	39823	79278	26590
03 B 51690	43998	23359	04198	80160	09597	19716	38488	39968
23 D 19054	58938	08884	06809	80402	50763	38802	13359	87186
25 F 19636	41108	08884	34906	80402	04960	51971	12755	59869
11 D 32175	10780	39412	65663	80494	85667	40023	48499	99003

08 F 47831	74200	63686	61738	80503	26026	53883	55341	03734
25 F 47831	45435	40196	26419	80503	74878	26631	88157	90221
08 J 89015	72296	28563	89954	80941	85636	26488	22813	44911
23 D 87186	35420	86088	54569	81059	47831	30457	39661	89113
11 C 47545	19419	63281	63442	81194	25979	32175	10780	39412
15 B 57357	57180	20323	23570	81265	59019	08884	34951	35339
05 C 06160	08357	23453	48538	81390	02576	99476	53296	65187
10 A 00000	47039	47124	87057	81440	59500	37134	40452	95726
13 B 95207	50656	08547	09597	81528	74554	53504	92227	65071
08 G 03734	57191	08894	56788	81671	00454	16951	68942	54137
14 C 03546	40424	43631	73327	81818	20387	68171	69152	31762
08 B 14969	29692	23363	60274	81885	09597	56195	88927	00084
05 D 65187	01785	36730	27130	81966	40334	41596	62200	13486
23 E 39661	89113	96633	02599	82044	97857			
18 F 44010	88488	78207	06423	82065	69523	37234	66155	10512
20 C 21245	29739	47022	08884	82071	31613	79059	43139	50007
22 B 71543	87203	79225	09597	82140	45666	02756	84284	31450
25 B 96743	83197	33083	09597	82140	45666	02756	84284	31450
14 E 45300	12829	92523	02090	82206	45042	26325	04697	05236
19 A 89418	91468	84355	75498	82206	07408	08577	57290	10435

15 D	15117	43616	26038	31023	82412	00853	89695	17876	56788
23 A	12345	86714	66802	86317	82621	90981	52159	75938	48550
24 F	07152	11901	11887	66802	82621	90981	52159	75938	64071
20 F	31931	20409	72019	39243	82716	08346	49859	70204	83821
14 A				67890	82825	75938	03447	14724	18774
08 A				34567	83185	93757	32758	87550	31934
25 A				23456	83185	93757	33758	87550	50241
25 A	50241	67713	14676	96743	83197	33083	09597	82140	45666
08 B	09597	56195	88927	00084	83234	18783	06863	78992	00915
07 B	79278	26590	39940	43131	83413	41401	89989	55587	59811
07 J	02849	24021	63529	19266	83498	30453	91160	86733	66301
17 E	94260	10431	48702	12214	83552	52147	47831	67610	63497
26 F	83995	24072	28041	41271	83738	37015	02192	58153	02790
18 F	11148	10253	37201	66039	83763	89077	67272	69437	99373
12 A	26633	34123	40178	62293	83786	64990	78893	89717	38014
20 F	82716	08346	49859	70204	83821	49780	44138	57924	22564
17 G	72325	25204	56788	07385	83892	75765	45195	72085	49728
28 E	47758	85865	33971	75938	83991	08258	89110	57869	37845
26 E	20610	51275	08772	40373	83995	24072	28041	41271	83738
02 C	97224	06828	90818	47758	84147	31012	75938	79319	69898

20 B 36730	16028	66495	24853	84149	09689	22683	20323	21245
22 D 36730	18954	03645	31439	84149	09689	49017	20404	09860
12 B 57155	47135	70400	87569	84180	00854	12944	18406	34459
04 F 47937	75972	22900	56030	84258	50890	09751	47300	53375
02 A	34567	60730	74769	84260	03391	18187	52608	65464
22 B 09597	82140	45666	02756	84284	31450	97241	90818	59426
25 B 09597	82140	45666	02756	84284	31450	97241	47116	34577
18 H 30481	05164	33922	22954	84315	44550	23308	67045	18168
19 A 56789	06441	89418	91468	84355	75498	82206	07408	08577
01 B 05744	50524	78007	09597	84359	22385	12393	78565	32842
04 D 39375	98051	90702	26242	84663	85047	90709	26240	44842
07 F 39375	98051	90742	26217	84663	85047	90762	26212	36011
25 D 73187	19968	44143	30747	84730	00594	56608	19636	41108
17 B 22897	17048	60039	01655	84734	74917	69126	75938	25178
04 D 98051	90702	26242	84663	85047	90709	26240	44842	55135
07 F 98051	90742	26217	84663	85047	90762	26212	36011	92403
15 C 91140	04594	39477	99025	85071	47831	22198	55249	15117
09 A	45678	27678	86657	85127	09743	50429	52304	42160
24 B 11297	78420	30525	62677	85249	72296	74621	06765	88821
07 F 71296	65938	22713	33316	85330	02361	39375	98051	90742
05 A			67890	85486	47842	72346	65464	70505

26 G 53311	20275	44907	10266	85569	42166	93556	45574	11879
08 J 72296	28563	89954	80941	85636	26488	22813	44911	25161
11 D 10780	39412	65663	80494	85667	40023	48499	99003	74415
01 A	78901	60730	74769	85760	97799	11228	73928	65464
07 B 89989	55587	59811	50244	85833	54220	08686	18073	51834
28 D 92398	06089	90818	47758	85865	33971	75938	83991	08258
29 B 47196	49230	87871	00154	85903	90641	92132	51777	
23 D 38802	13359	87186	35420	86088	54569	81059	47831	30457
23 A	12345	86714	66802	86317	82621	90981	52159	75938
07 G 39231	23096	32993	50602	86357	98842	55747	00243	55983
29 A 52487	63198	61691	78601	86447	18244	72350	47851	09597
16 C 20686	45136	74412	24455	86493	56912	74309	91669	69083
05 R 09597	71500	04932	97336	86649	90441	39903	49020	71683
09 A		45678	27678	86657	85127	09743	50429	52304
23 A			12345	86714	66802	86317	82621	90981
14 C 68171	69152	31762	08884	86724	06233	88907	72116	45883
07 J 19266	83498	30453	91160	86733	66301	44710	88393	
26 H 04503	59434	30453	91160	86733	66301	44726	88317	
17 H 68877	30482	96447	52566	86992	41511	99871	29548	17648
05 A 72346	65464	70505	29830	87014	09597	71500	04932	97336

10 A	00000	47039	47124	87057	81440	59500	37134	40452
08 F 88868	66886	95886	45027	87152	04412	12133	11021	15415
23 D 80402	50763	38802	13359	87186	35420	86088	54569	81059
22 A 18187	52608	65464	71543	87203	79225	09597	82140	45666
08 A 34567	83185	93757	32758	87550	31934	14969	29692	23363
25 A 23456	83185	93757	33758	87550	50241	67713	14676	96743
12 B 56912	57155	47135	70400	87569	84180	00854	12944	18406
29 B 43783	78345	47196	49230	87871	00154	85903	90641	92132
16 B 78968	74472	23223	19621	87995	19234	20686	45136	74412
08 K 97021	00194	08563	02651	88039	15573	76585	16901	
25 G 26419	80503	74878	26631	88157	90221	05317	02642	56788
26 I 91160	86733	66301	44726	88317				
07 J 91160	86733	66301	44710	88393				
04 R 31834	77584	25231	53285	88416	00894	34207	09962	55107
12 A			23456	88476	26633	34123	40178	62293
18 E 41785	91152	67922	44018	88484	11148	10253	37201	66039
07 A 00000	21388	75980	44010	88488	04010	80086	89054	39823
18 F 69437	99373	33908	44010	88488	78207	06423	82065	69523
24 R 85249	72296	74621	06765	88821	89609	02095	21802	56639
08 E 46827	27509	08884	34096	88868	66886	95886	45027	87152

08 C 75938	24194	08438	05789	88902	96446	51788	31508	44590
14 C 31762	08884	86724	06233	88907	72116	45883	19701	50827
25 C 75938	97686	56422	92853	88908	78320	64675	22322	65604
08 R 60274	81885	09597	56195	88927	00084	83234	18783	08863
20 A				89012	13667	74422	09942	61114
08 I 19857	13846	32538	09485	89015	72296	28563	89954	80941
18 A 75980	74006	15426	64834	89020	31384	99398	08718	92949
07 A 44010	88488	04010	80086	89054	39823	79278	26590	39940
18 E 10253	37201	66039	83763	89077	67272	69437	99373	33908
25 C 31450	97241	47116	34577	89082	04543	75938	97686	56422
28 E 33971	75938	83991	08258	89110	57869	37845	12396	
23 E 81059	47831	30457	39661	89113	96633	02599	82044	97857
17 C 65187	19066	36730	19431	89180	02514	26776	14358	22459
22 E 49017	20404	09860	31893	89332	08884	02142	95240	51771
01 C 75938	69713	19298	08276	89338				
19 A		56789	06441	89418	91468	84355	75498	82206
09 R 42160	62278	10915	35347	89450	72296	49146	98213	25433
10 C 63306	18447	00203	55463	89546	03256	62701	93387	47957
24 B 72296	74621	06765	88821	89609	02095	21802	56639	03217

15 D	26038	31023	82412	00853	89695	17876	56788	32008	20530
12 A	62293	83786	64990	78893	89717	38014	02400	56912	57155
14 B	55925	78320	76911	41828	89803	65060	70915	36730	31382
17 F	67610	63497	14594	75579	89892	12916	97446	04794	72325
08 J	49485	89015	72296	28563	89954	80941	85636	26488	22813
07 B	39940	43131	83413	41401	89989	55587	59811	50244	85833
22 H	56788	69119	99501	43804	90106	67638	65837	18061	52002
14 I	45609	73039	30727	78968	90194	07645	66919	21177	60802
18 B	92949	94457	43192	91850	90213	58594	30248	28807	49010
25 G	80503	74878	26631	88157	90221	05317	02642	56788	28462
05 B	71500	04932	97336	86649	90441	39903	49020	71683	52245
16 D	28854	75700	22645	05583	90584	64880			
29 B	49230	87871	00154	85903	90641	92132	51777		
13 C	92227	65071	32860	99163	90656	15734			
04 D	44245	55171	39375	98051	90702	26242	84663	85047	90709
04 D	90702	26242	84663	85047	90709	26240	44842	55135	42507
07 E	85330	02361	39375	98051	90742	26217	84663	85047	90762
15 D	32008	20530	35625	01877	90742	49854	49894	38560	43563
07 F	90742	26217	84663	85047	90762	26212	36011	92403	14384
23 C	48749	34158	61477	07169	90806	19054	58938	08884	06809

02 H	53504	79786	97224	06828	90818	47758	84147	31012	75938
22 H	02756	84284	31450	97241	90818	59426	32338	17817	75938
28 D	53423	18805	92398	06089	90818	47758	85865	33971	75938
17 J	40914	70213	78968	32423	90932	75623			
23 A	86714	66802	86317	82621	90981	52159	75938	48550	08438
24 F	11901	11887	66802	82621	90981	52159	75938	64071	48550
15 R	35339	11080	39132	97787	91140	04594	39477	99025	85071
18 D	98528	95389	33258	41785	91152	67922	44018	88484	11148
07 J	63529	19266	83498	30453	91160	86733	66301	44710	88393
26 H	52956	04503	59434	30453	91160	86733	66301	44726	88317
14 H	05306	95232	07828	53760	91315	49149	05595	45609	73039
19 A		56789	06441	89418	91468	84355	75498	82206	07408
26 D	23308	67045	47993	11631	91662	51608	12870	75061	44081
16 C	24455	86493	56912	74309	91669	69083	79291	73568	28854
20 G	57924	22564	47562	62651	91786	72296	10144	63305	60912
26 C	54478	63945	63933	73249	91816	39490	43441	29972	54088
11 A	21388	75980	09987	18562	91842	97538	17722	64318	33230
18 B	08718	92949	94457	43192	91850	90213	58594	30248	28807
21 A	97787	01247	54761	40195	91932	49674	73800	27054	16174
29 B	87871	00154	85903	90641	92132	51777			
20 D	07484	07101	27078	20218	92134	47831	18576	49284	58574

13 H 09597	81528	74554	53504	92227	65071	32860	99163	90656
28 D 70108	18247	53423	18805	92398	06089	90818	47758	85865
07 F 85047	90762	26212	36011	02403	14384	54683	06696	74423
09 B 49146	98213	25433	01091	92472	67275	70753	76254	77776
21 C 05225	92627	10409	01091	92472	73877	77612	60934	56456
14 D 59362	47831	45300	12829	92523	02090	82206	45042	26325
03 A 23456	51747	33040	45035	92588	93926	02329	56912	57146
21 C 60245	02579	72296	05225	92627	10409	01091	92472	73877
17 A 67332	09839	20013	09597	92628	58839	43662	22897	17048
03 C 15224	21026	14932	04830	92822	18800			
26 G 42166	93556	45574	11879	92841	69492	22751	35924	35543
10 B 43769	22367	30912	23938	92842	45442	63306	18447	00203
25 C 04543	75938	97686	56422	92853	88908	78320	64675	22322
14 E 45042	26325	04697	05236	92941	56788	13846	79249	58757
07 H 55747	00243	55983	08718	92949	94490	43118	00677	45747
18 B 89020	31384	99398	08718	92949	94457	43192	91850	90213
18 D 43776	54198	11084	03512	93107	98350	30353	31834	77584
04 F 26240	44842	55135	42507	93162	61012	08101	22712	33316
25 G 02642	56788	28462	48531	93195	08232	56546	14266	49894
15 A			12345	93205	29567	49097	61498	79034

10 D 52461	35134	63029	00598	93272	62725	11364	
10 C 55463	89546	03256	62701	93387	47957	56542	35134
26 G 44907	10266	85569	42166	93556	45574	11879	69492
05 H 51552	40147	10058	24017	93636	26300	34722	28735
07 I 71120	42084	15901	42462	93639	39286	19584	02849
17 I 29548	17648	72296	57638	93647	68574	08687	39374
08 A		34567	83185	93757	32758	87550	14969
25 A		23456	83185	93757	33758	87550	67713
17 C 43051	15871	31467	17429	93788	14997	65187	36730
03 A 51747	33040	45035	92588	93926	02329	56912	73077
14 F 41738	31940	17632	78394	94186	49689	08346	18029
17 E 52103	39614	39270	08245	94260	10431	48702	83552
18 B 31384	99398	08718	92949	94457	43192	91850	58594
04 C 34207	09962	55107	00510	94490	43118	28374	36417
07 H 00243	55983	08718	92949	94490	43118	00677	79769
08 I 01109	08346	52660	69815	94749	42416	52566	13846
03 B 57146	73077	56769	67046	94811	51690	43998	04198
11 B 68539	09612	57916	79479	95167	20190	55088	28079
13 B 08618	97104	09620	49527	95207	50656	08547	81528
14 H 60770	17815	72296	05306	95232	07828	53760	49149

22 E 31893	89332	08884	02142	95240	51771	46489	23198	70621
06 B 11887	47678	55827	51709	95294	75938	26264	42279	05420
18 D 30353	31834	77584	98528	95389	33258	41785	91152	67922
07 G 14384	54683	06696	74423	95398	39231	23096	32993	50602
23 C 65961	41821	36730	56164	95398	49245	48749	34158	61477
06 C 30513	40235	79296	23341	95497	41487	60109	56671	75931
17 H 49728	24022	50062	27248	95594	08346	04073	68877	30482
05 B 39903	49020	71683	52245	95650	75938	06160	08357	23453
10 A 81440	59500	37134	110452	95726	22773	33306	22772	33306
25 F 59869	26246	80022	97715	95764	47831	45435	40196	26419
08 E 08884	34096	88868	66886	95886	45027	87152	04412	12133
28 C 40462	02400	56912	57146	95948	73602	53544	13945	73843
08 C 24194	08438	05789	88902	96446	51788	31508	44590	76924
17 H 08346	04073	68877	30482	96447	52566	86992	41511	99871
15 E 43563	52956	28816	08346	96517				
05 I 36404	04985	64758	39284	96522				
17 H 74917	69126	75938	25178	96522	43051	15871	31467	17429
23 E 47831	30457	39661	89113	96633	02599	82044	97857	
25 A 87550	50241	67713	14676	96743	83197	33083	09597	82140
04 G 53375	30951	59811	50244	96899	07317	72856	36254	50495

24 F	22897	70210	08694	52962	96934	67027	70558	16312	49097
08 K	62200	78968	40436	59777	97021	00194	08563	02651	88039
13 A	23130	05042	22899	08618	97104	09620	49527	95207	50656
02 B	48828	00755	53504	79786	97224	06828	90818	47758	84147
22 B	45666	02756	84284	31450	97241	90818	59426	32338	17817
25 B	45666	02756	84284	31450	97241	47116	34577	89082	04543
05 B	87014	09597	71500	04932	97336	86649	90441	39903	49020
17 F	14594	75579	89892	12916	97446	04794	72325	25204	56788
22 C	32338	17817	75938	17283	97533	42961	04438	25035	52867
11 A	75980	09987	18562	91842	97538	17722	64318	33230	00454
20 E	58574	72333	44305	02095	97571	99387	10260	25204	56788
25 C	34577	89082	04543	75938	97686	56422	92853	88908	78320
25 F	12755	59869	26246	80022	97715	95764	47831	45435	40196
28 C	73843	65202	18406	72170	97750	09597	70108	18247	53423
08 H	68942	54137	54707	47383	97777	17927	01109	08346	52660
15 B	34951	35339	11080	39132	97787	91140	04594	39477	99025
21 A			78901	38482	97787	01247	54761	40195	91932
01 A	78901	60730	74769	85760	97799	11228	73928	65464	05744
23 E	89113	96633	02599	82044	97857				
18 I	55008	76528	10566	49364	97937	40023	48499	99003	77415

1A C 30248	28807	49010	23147	97949	25972	53084	29734	16187
04 D 62180	44245	55171	39375	98051	90702	26242	84663	85047
07 E 33316	85330	02361	39375	98051	90742	26217	84663	85047
09 A 35347	89450	72296	119146	98213	25433	01091	92472	67275
18 D 54198	11084	03512	93107	98350	30353	31834	77584	98528
20 F 10260	25204	56788	63375	98430	19149	02646	56690	31931
18 D 98350	30353	31834	77584	98528	95389	33258	41785	91152
07 G 23096	32993	50602	86357	98842	55747	00243	55983	08718
14 G 49689	08346	52660	18029	98855	08999	14665	99640	46021
22 F 63421	27801	75656	47831	98887	63596	35519	25954	40257
04 G 50495	35184	40023	48499	99003	74415	11805		
11 D 80494	85667	40023	48499	99003	74415	11863		
18 I 49364	97937	40023	48499	99003	77415	11860		
15 C 97787	91140	04594	39477	99025	85071	47831	22198	55249
13 C 53504	92227	65071	32860	99163	90656	15734		
07 D 00312	24103	53463	44217	99232	61012	06101	22710	33314
12 D 45328	08438	11367	53532	99303	10830	02314	75658	
26 E 09962	36417	62180	33141	99371	20610	51275	08772	40373
18 F 83763	89077	67272	69437	99373	33908	44010	88488	78207
20 F 72333	44305	02095	97571	99387	10260	25204	56788	63375

18 A	15426	64834	89020	31384	99398	08718	92949	94457	43192
05 C	23453	48538	81390	02576	99476	53296	65187	01785	36730
22 G	05236	72911	56788	69119	99501	43804	90106	67638	65837
14 G	18029	98855	08999	14665	99640	46021	10956	60770	17815
17 H	96447	52566	86992	41511	99871	29548	17648	72296	57638

INDEX

additive -

- additive systems have been used historically for diplomatic and military communications. v
- additive systems likely find use somewhere today. v
- additive may be recovered or solved by putting messages "in depth". 15
- additive usually appears on an "additive page" in the form of a square. 9
- characteristics of additive (groups) may be reflected in the enciphered code when encicode groups which have been enciphered with the same additive are examined. 8
- relativity of "additive". 21-23, 30
- use of "additive" has been a traditional and conventional method for the (super)encipherment of digital codes. v

assumptions -

- certain tentative assumptions can be made from examination of the traffic. 29
- see, also, "hypotheses".

base -

- an arbitrary base for placode groups may be established. 18
- cryptanalyst may (in some circumstances) adjust recovered (placode) groups to their original base. 21-23
- differences may be used to put columns on a common base, even though no placode groups have yet been identified. 26-28
- relativity of additive and placode groups (may be set to any base). 21-23

"beginning point" -

- the "beginning point" of additive used for a particular message is indicated by the "message indicator". 12

"beginnings" -

- it is good cryptanalytic practice to line up the "beginnings" of messages. 6

blind attack -

- a blind attack against a (cryptographic) system is usually not made — there is usually some collateral information available (which tells the cryptanalyst something about the system). 16

call-signs -

messages to the same call-signs (may often) begin with the same placode groups. 31

traffic analysis may provide "collateral information" in the form of identification of call-signs. 16

"XYZ de STS" means message is to XYZ from STS. 17

"characteristics" in the placode -

"characteristics" in the placode may be reflected in the enciphered code when enciccode groups with the same "additive" are examined. 8

"characteristics" in the placode may often be found by examining enciphered code groups which have been enciphered with the same additive. 7-8

"characteristics" of the placode (are a great assist) in putting messages "in depth". 30

certain positions in the placode may be odd or even. 7

digits in certain positions may "sum" to certain values. 7

limitations in the placode groups, such as groups running exclusively from 00000 to 25000. 7

placode groups may "sum to zero", i.e., 8976, 6068, 0703, etc. 7-8

check groups -

are there "check groups" in the principal problem? 30

check groups are in effect "nulls" that provide no textual content to messages. 11

null groups may periodically be added to the enciccode to serve as "check groups" to insure (to the receiving code clerk) that the proper additive is being applied to the message. 9

though the relative order of the check groups may be known, their relationship to the "enciphering square" (from which the additive comes) may not be known. 10

check groups, like "characteristics" in the placode groups, will enable the cryptanalyst to place messages "in depth". 9-10

collateral information -

collateral information (about a cryptographic system) includes the enemy's method and form of writing messages, phraseology, stereotypes used, etc. 16

collateral information is often a great assist to cryptanalysis. 16

usually there is some collateral information available which will assist the cryptanalyst so that he does not have to attack the system completely in the blind. 16

coordinates -

coordinates are a common method of designating points or cells within a square which contains additive. 11-12

the "enciphering square" coordinate designations provide a means of designating additive "beginning points" — and such coordinate designations become "message indicators". 14

cryptanalytic attack against an enciphered code system -

the first step normally consists in preparing a "message print" and "message index" of intercepted traffic. 4

differences -

cryptanalyst should (thoroughly) understand the concept of "differences" if he wishes to be successful in solving an "additive-type" enciphered code system. 23

concept of "differences" is based upon the fact that the differences between two placode groups is the same even though both are enciphered with the same additive. 23

high-frequency placode group differences may be used to recover the "additive" of a column which contains high-frequency placode groups. 24-26

differences may be used to put columns on a common base, even though no placode groups may have yet been identified. 26-28

to obtain a "difference" the subtraction is made so that the smallest "difference" between two groups is obtained, not the reciprocal larger "difference". 23-24

"Difference Table" -

a "Difference Table" provides the differences between all groups (of those being considered). 24

encicode -

definition. v

a portmanteau word coined by William F. Friedman. v

"hits" -

see "repetitions".

hypotheses -

cryptanalyst makes an hypothesis and then attempts
to confirm (or disprove) it. 17

in the "miniature" problem the hypothesis is made
that code groups represent single-letter plaintext
letters 18

"in depth" -

by means of repetitions messages can be put
"in depth". 30

"in depth" means superimposing messages that
have been enciphered with the same additive. 9-11, 30

once messages are "in depth" (in the present
problem) what conclusion can be reached as to
the total number of "additives" in the system? 30

putting all messages "in depth" is not always
an easy task. 30

messages that begin at the same point will use
the same additive and sometimes may be put
into depth. 16-17

solution of the indicator system usually will
make the task of putting messages "in depth"
easy and almost mechanical. 14

with messages "in depth" the search for "message
indicators" may be simplified. 30

indicator(s) -

enciphered indicators are often difficult to
find. 6

if a pattern is found in groups occupying certain
positions in messages, the groups may be
"indicators". 6

usually the indicator system is attacked first;
and if successful, the messages then are put
"in depth". 14

intercept times -

the exact times that messages have been intercepted
may be valuable 16

INTRODUCTION

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message "beginnings" -

see "beginnings"

message index -

definition.

4

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message indicator is usually found in the first or last several groups of a message.	12, 30
search for "message indicator" (usually) begins with a tabulation of the first several and last several groups of the messages.	12
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null groups may serve as an easy, convenient method to place messages "in depth".	9

numbering system -

the numbering system of enciphered messages and
plaintext messages may be the same. 16,31

one-part code -

in a one-part code the plaintext equivalents
are in alphabetical order while at the same
time the placode groups are in numerical order. 22

in the case of a one-part code, the problem of
putting recovered placode groups on the same
base as the original code groups is greatly
facilitated. 21-22

placode -

definition. v

a portmanteau word coined by William F. Friedman. v

recovery of "additive" and the identification
of placode. 18-20

relativity of "placode". 21-23, 30

where there is a "characteristic" in the
placode, it may often be found by examining
enciphered groups that have been enciphered
with the same "additive". 7

PRELIMINARY REMARKS CONCERNING THE PROBLEM 29-32

premise -

see "hypotheses".

principal problem -

(THE) PROBLEM 33-61

original purpose of problem was to train
British cryptanalysts. 29

BACKGROUND TO THE PROBLEM 31-32

problem is in English. 29

problem is not an easy one. 29

problem is the pièce de résistance of the book 28

scene of the problem is North Africa in
January 1941. 29, 31

student may solve the problem if he understands
the solution to the "miniature" problem. vi, 28

probable word method -

probable word method may be used in code
analysis: messages are assumed to begin with
the word "TO". 17

repetitions -

cryptanalyst may fall back upon repetitions or "hits" in order to put messages "in depth". 17

locations of "hits" (within messages) may be significant. 8

one of the principal purposes of the "message index" is to find repetitions between messages. 5

repetitions are noted in messages "in depth". 17

term "hits" means "repetitions". 6-7

with a large number of "hits" between messages, it is evident that the messages have been enciphered with the same "additive". 7

solution of the principal problem -

after messages are "in depth" can the "message indicators" be identified? 30

after messages are "in depth" what conclusions can be reached as to the total number of additives in the system? 30

BACKGROUND TO THE PROBLEM 31-32

by means of repetitions certain messages can be put "in depth". 30

clue to solution of the second system may be found on page 469 of Kahn's book The Codebreakers. 31

perseverance will lead to success! 31

reconstruction of relative placode. 30

stereotype "beginnings" and "endings" of messages will assist the cryptanalyst. 31

traffic divides itself into two systems. 29

solution of the principal problem will take certain steps. 29-31

stereotype message "beginnings" -

stereotype message "beginnings" will aid the cryptanalyst. 18, 31

stripping additive -

stripping additive from messages "in depth". 18-20

stripping additive means recovering or solving additive from messages "in depth". 15

traffic analysis -

extracts from the Italian Order of Battle published by the Intelligence Branch of the General Staff. 32

identification of call-signs and personnel in units.	3-4, 17
traffic analysis provides "collateral information" in the form of identification of call-signs and names of commanders of enemy units.	16
traffic analysis provides valuable information to help cryptanalysis.	3-4
Wireless Intelligence Service provides identification of Italian stations.	32

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